

ROADS AND STREETS

ROADWAYS
AND
HEAVY CONSTRUCTION

NOVEMBER 1961



FOOTE COMPANY uses a total of 36 Timken bearings in the Multifoote Duomix 34E paver. Vital application points include main reduction gear case, drum rollers, and traction drive pinion shafts.

Saves as it paves...with help of TIMKEN® bearings

HOLDING down the cost of building roads was one big objective that engineers had in mind when they designed this Multifoote Duomix 34E paver. That's why they specified Timken® tapered roller bearings at vital points, including twin disc clutch, main reduction gear case, traction drive pinion shaft, drum drive shaft, drum rollers, skip hoist cable drum, power boom swing and lift mechanism, bucket rollers and discharge chute hanger support.

Timken bearings hold up with negligible wear under the heaviest loads. They help related parts last longer by keeping them in proper alignment. They reduce lubrication time. As a result, costly maintenance and down-time hours are minimized.

Timken bearings hold gears and shafts in proper alignment because their tapered construction takes radial and thrust loads in any combination. Line contact between rollers and races gives extra load-carrying capacity. True rolling motion plus an incredibly smooth surface finish makes friction negligible.

Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel, are engineered for the job and precision

manufactured—three reasons why Timken bearings normally last the life of the machine.

No other bearing can give you all the advantages you get with Timken bearings. That's why bearings with the trademark "Timken" are industry's No. 1 choice. Insist on them when you buy. Specify them when you build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN
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TAPERED ROLLER BEARINGS



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13-cu. yds. heaped

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176 HP BUDA 6DA779
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For power that's usable in the pit,
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HYDRAULICALLY CONTROLLED
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. . . over 21 mph means more trips
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Add to these big performance features
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typical of all LaPlant-Choate scrapers
and you have an agile, powerful
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on long haul jobs. See
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WHEN your job calls for greater volume, use the high speed
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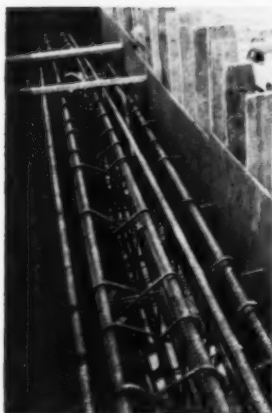


Hydraulic and Cable-operated
Dozers.



Beginning of the western extension—the Irwin interchange, east of Pittsburgh. The new four-lane highway, 67 miles long, has six interchanges to principal north-south routes.

Pennsylvania Turnpike Goes West



F. Y. Dunn (left), resident engineer, Pennsylvania Turnpike Commission, and W. S. "Buckets" Bell (right), paving superintendent, talk over the job with Contractor Frank Mashuda.

Close-up of Bethlehem Reinforcing Bars installed in bridge. Bars have high, closely-spaced lugs to prevent slippage in concrete.

Graded surface is dampened before first-course pouring. Bethlehem Dowel Unit, in foreground, keeps dowels accurately aligned in concrete, horizontally and vertically. Hook bolts visible at left.



WITH the opening of the western extension of the Pennsylvania Turnpike System, motorists now may enjoy 327 miles of uninterrupted express-highway driving from King of Prussia, near Philadelphia, to the Ohio border.

Smaller pictures here show construction on a portion of the Turnpike north of Pittsburgh. The contractor was Frank Mashuda Company, Milwaukee. Bethlehem, well represented along the entire Turnpike, supplied dowel units, bridge reinforcing and hook bolts.

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On the Pacific Coast, Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation, Export Distributor: Bethlehem Steel Export Corporation

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ROADS AND STREETS

November, 1951 • Vol. 94 • No. 11

Roads and Streets represents 59 years of continuous publishing in the highway field; combined with Engineering & Contracting and Good Roads Magazines, established in 1892

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HALBERT P. GILLETTE, Editor-in-Chief

H. J. CONWAY, Assistant Publisher

Coming Articles

Construction Methods

Contractor paved dry creek bottom for traffic detour. Beat rainy season by matter of hours!

Tripod-mounted flasher units helped contractor handle 12,000 vehicles daily through concrete paving job.

Some interesting new job "kinks" coming along.

Bridge Design, Construction

California's method of controlling quality of welds on all-welded bridge construction. How a bridge was split in two in Kentucky to widen it.

Kentucky's new road bridges around Wolfe Creek Dam (very high piers).

Soils and Roadbed

California has evolved a new and important approach to flexible pavement design. Is the CBR going out the window?

Street Programs

Soil-cement has certainly proved popular in Peoria. Story coming. Miles of new suburban streets on this city's docket. Notes on methods.

Concrete Paving

Nebraska trying Fly Ash in p.c. concrete pavement mix.

How an Ohio project was built in near-record time.

Maintenance

How far have we come in mechanization? How far to go? What methods yet to learn or apply? An authority gives some answers.

Meetings

Technical report on the AASHO meeting at Omaha, next month.

HAROLD J. McKEEVER, Editorial Director
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Col. V. J. Brown, Associate Editor
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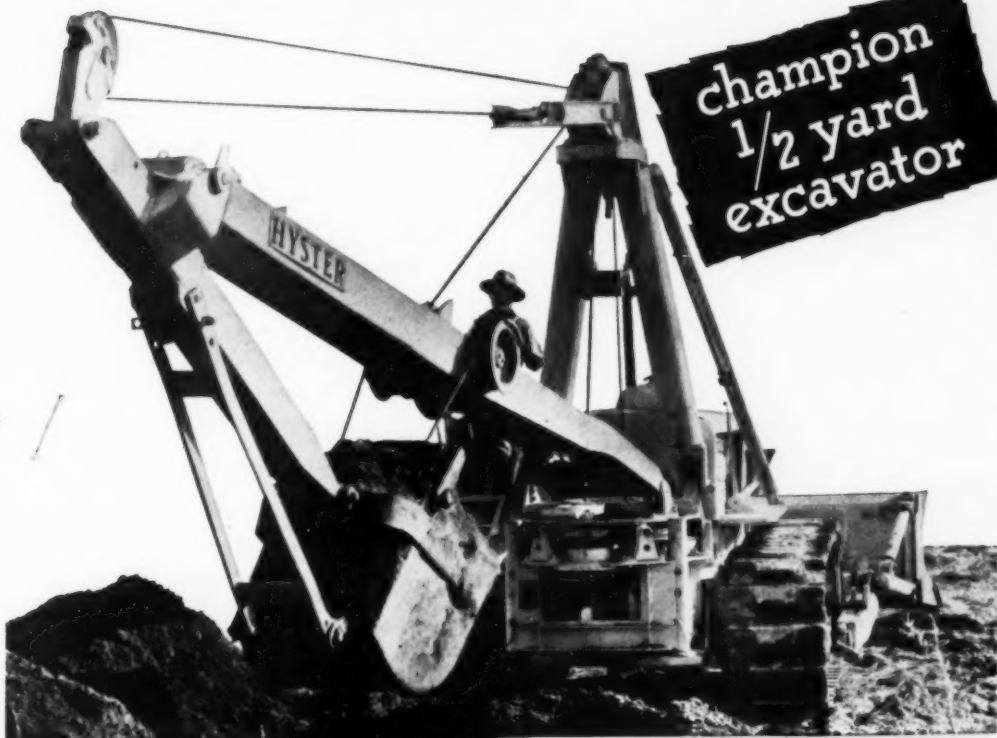
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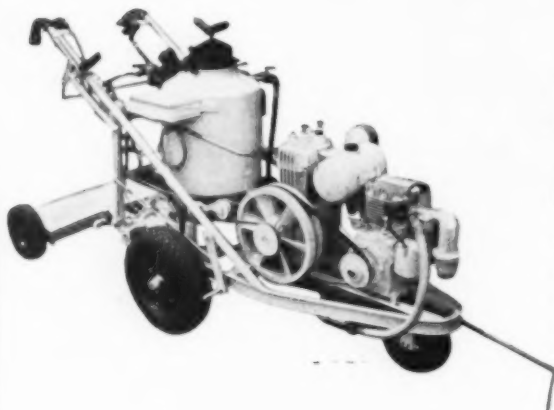
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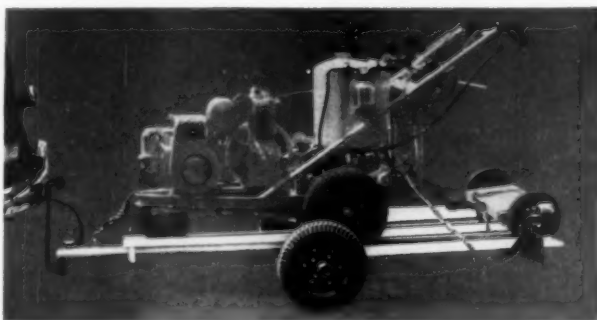
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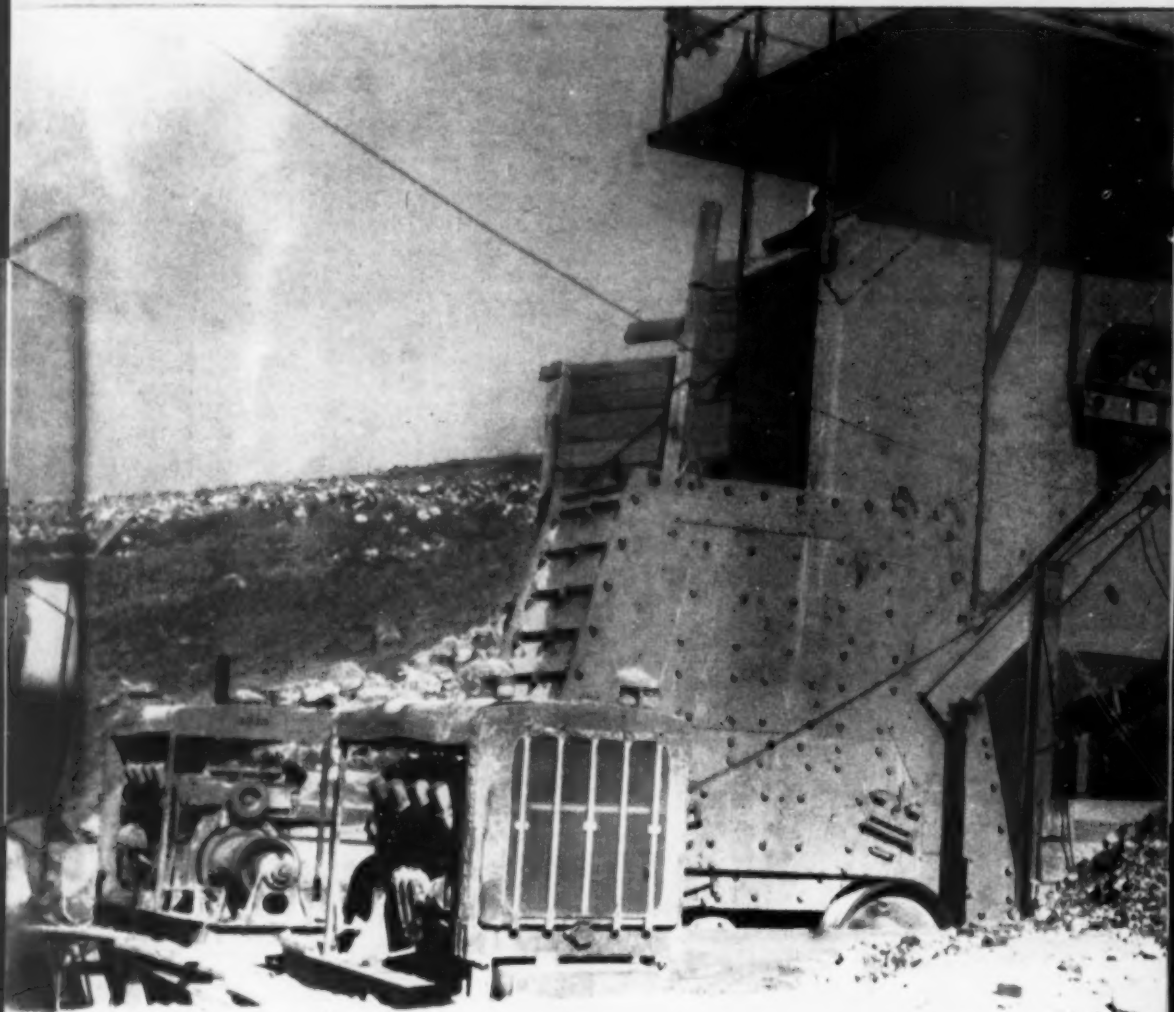
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- ✓ Originally scheduled to produce 400 tons per hour.
- ✓ 600 tons per hour daily average maintained!
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And here's why you get such low production costs with Double Impeller Impact Breakers...

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- ✓ Approximately 50% less contact of stone on metal, because such a high percentage of material is broken in suspension.
- ✓ You get an extremely high ratio of reduction at extremely low power costs.
- ✓ You save on your plant investment because you can eliminate much accessory equipment such as secondary crushers, conveyors, hoppers, screens, elevators, etc.

Get ready for your share of the big jobs ahead with a Cedarapids Double Impeller Impact Breaker in your plant. "Construction Unlimited" means OPPORTUNITY UNLIMITED for you when you're prepared for bonus production. You can get very prompt delivery on all four sizes of Double Impeller Impact Breakers. See your Cedarapids distributor today for a profitable future.

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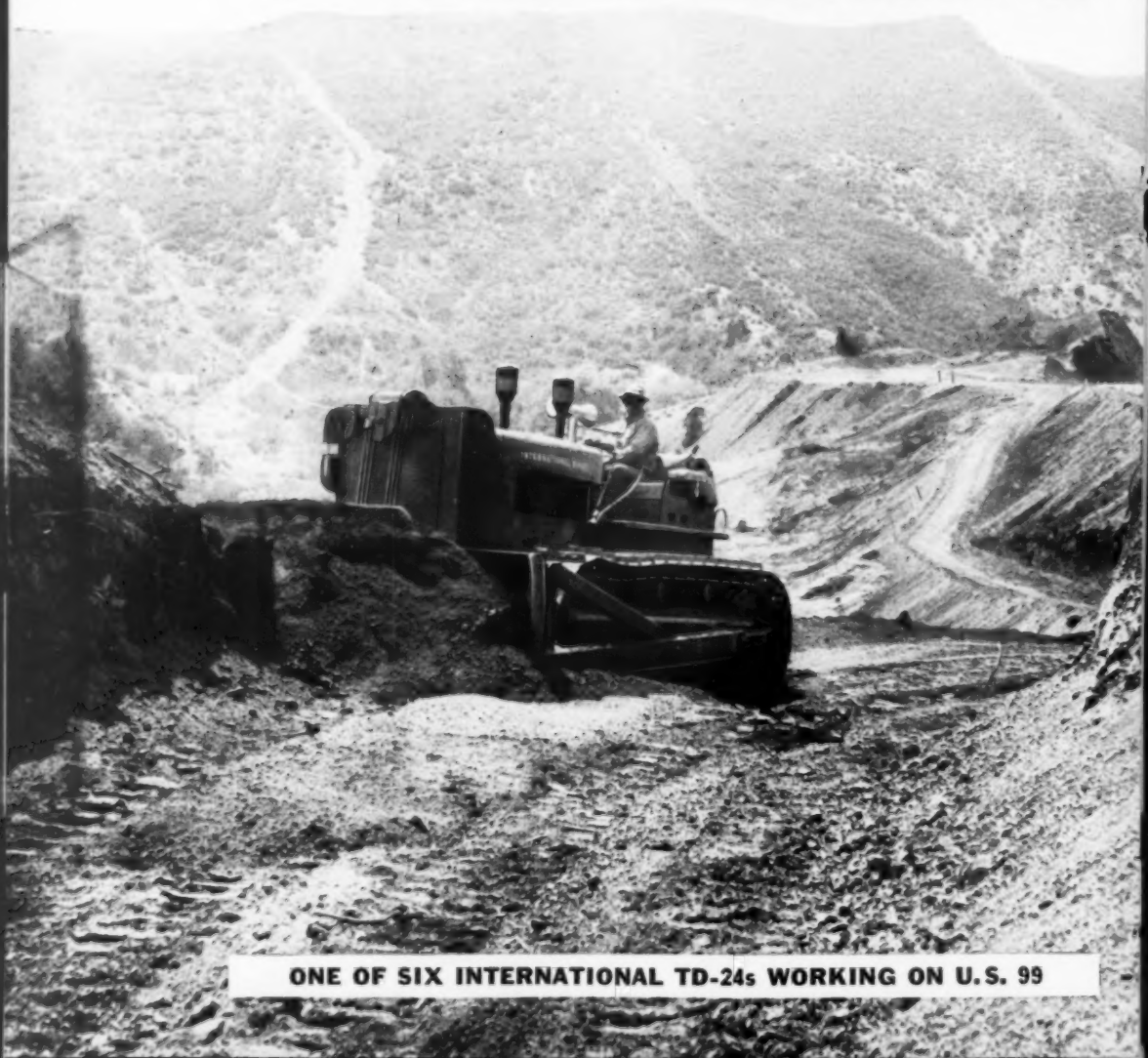
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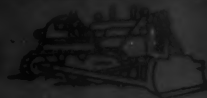
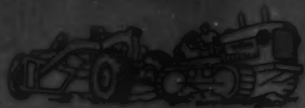
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TD-24 Power—148 maximum horsepower at the drawbar, more than any other crawler on the

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Ask your International Industrial Distributor for details on the TD-24. Consider his on-the-job service and complete shop facilities, at your call through the years ahead. Get the whole low-down! You'll be a TD-24 man from then on in!

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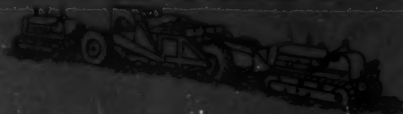
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POWER THAT PAYS



1,200,000 YARDS TO MOVE—and one of A. Teichert's International TD-24s gets it. Among crawler tractors, the Big Red TD-24 is the Champ, with more power and speed to move more paydirt per day.



SNOWLOADER* SAVES MONEY

**Cost of Unit Will Be Repaid
By Year's End**

(From The Norwalk Hour)

The Athey Force-Feed Loader, purchased by the city of Norwalk this year, may save enough city money to pay for itself before the year's end, Public Works Commissioner Paul J. James said today.

Statistics were produced to show that the efficient operation of the loader on snow removal tasks after last weekend's snowfall gave the city huge savings. Should there be additional snows this season further gains will be made.

Speed Cited For Lower Costs

(From The Norwalk Hour)

Reductions in time spent in clearing snow have brought down the cost of this operation. Commissioner James said, "With our two Athey Force-Feed Loaders we clear five to six times more snow than by previous methods."

"It used to take us 13 hours to clear snow, but now we do it in 4 with our Athey Loaders," reports Street Superintendent William Silk.

The streets and sidewalks of the business district are cleared completely before the 9:30 opening time each morning. Former methods of hand-shoveling, bulldozers, and power-shovels were a constant danger to street surfaces and users.

NORWALK BUYS 2nd SNOWLOADER*

(From The Norwalk Hour)

Members of the Board of Estimate and Taxation appropriated funds for the purchase of another Athey Force-Feed Loader at their meeting Wednesday night.

After hearing of the remarkable savings in time and labor that the first loader returned on snow removal tasks, the board agreed that the purchase of a second machine was good economy. Praise of the unit's operation was voiced by a delegation of local merchants who saw the Athey Loader at work saving their Christmas business.

SNOW REMOVAL TIME CUT BY TWO-THIRDS WITH NEW LOADER

(From The Norwalk Hour)



The heavy snowfall that hit Norwalk, Conn., last Sunday night, was cleared in just 4 hours with the city's new Athey Force-Feed Loader. According to Street Superintendent William Silk, this speedy removal represents the saving of some 9 hours of work. The machine is shown biting into high-piled snow.

MERCHANTS PRAISE CITY DEPARTMENT

In a letter to Commissioner of Public Works Paul James, the Retail Merchants Division of the Norwalk Chamber of Commerce extended their gratitude to the Commissioner and his workers for the excellent snow removal work done last week.

Sherwood Prothero, Executive Secretary for the Chamber, wrote, "Your efforts saved the Christmas business. The snowfall meant severe losses, until your department with its new Athey loader cleared the streets and saved the day."

The use of the Force-Feed Loader meant the difference between profit and loss!

EDITORIAL

(From The Norwalk Hour)

Norwalk's taxpayers got a chance last week to see its new snowloader* in action—and were amazed. The loader gathered snow at a great rate of speed and dropped it into waiting trucks which carted it away. There was no delay or loss of time

and the business areas were cleared quickly and efficiently, and certainly at a lower cost.

This one demonstration proved the worth of the Athey Force-Feed Loader. It also clearly showed that the city would be practicing false economy if it didn't buy a second loader this year.

*Athey Force-Feed Loader.

(From The Norwalk Hour)

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*Athey Force-Feed Loader.

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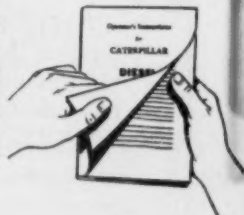
"Cat" Diesel Engines, Tractors, Motor Graders and Earthmoving Equipment are built with the stamina to serve you long and faithfully. But *how long* is up to you and the operation and maintenance you give them. Good care pays off.

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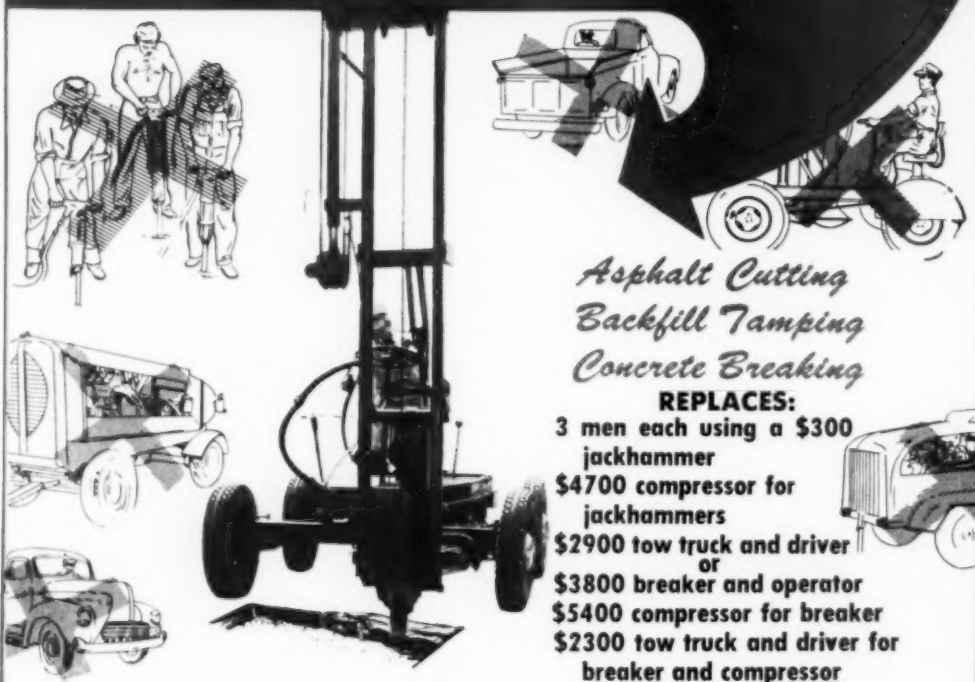


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breaker and compressor

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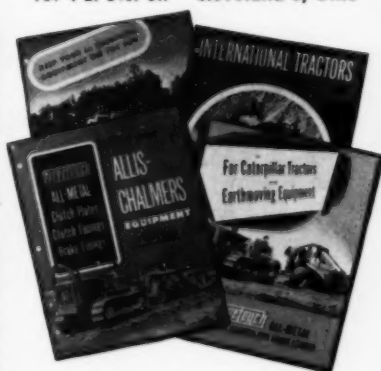
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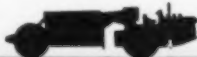
Turnaroeker makes short, 90° turn out of cut onto main haul road ... travels at high speeds through open traffic and up 5 to 6% grades on 1½-mile haul to dump. These 2 rear-dump, electric-control haulers are Whitcomb's latest LaTouneau units. He bought his first LaTouneau drivemovers in 1937 ... has been a regular repeat buyer since then.

NEW C Turnaroekers now have 18-ton body increasing capacity by 12½%. Prime movers with Tournamatic transmission and torque converters are also available, as well as the "Roadsters" with their heavy-duty, sliding-gear transmission. Performance figures reported here were made with earlier 16-ton Roadster units.

Profit Insurance—Turnaroeker body is readily interchangeable behind "C" prime mover with equipment shown below.



13.5-yd., 16-ton
TOURNAPULL



15-yd., bottom-dump
TOURNAHOPPER



20-ton, flat-bed
TOURNAHAULER



15-ton lift
TOURNACRANE



6 or 7-yd., transit mix
TOURNAMIXER

LET

Electro-heated body speeds sub-zero dumping. To speed completion of the 24-ft. sub-grade for 2.8 miles of Rt. 103 along Lake Sunapee, Frank Whitcomb worked Tournarockers well into the winter. Electrical induction heating of 'Rockar body kept load from freezing . . . allowed fast, free dump even in sub-zero weather. Other machines, unheated, had to be cleaned out by a small pull shovel.

Construction Corp.

2 C-TOURNAROCKERS move 51 to 56 pay yds. hourly on 3-mile cycles through traffic

Frank W. Whitcomb Construction Corp. of North Walpole, New Hampshire, have a lot of solid rock in the 245,000 yds. of excavation they're handling on relocation of 2.8 miles of Rt. 103 near Newbury. Even the common earth is hard to handle because of large boulders. Hauls are long . . . averaging 1½ miles one-way over existing highway through heavy, open traffic.

**Load 10 pay yds. of broken rock
...up to 15 loose yds. common earth**

To speed production under these tough conditions, Whitcomb has assigned most of the difficult hauling to 2 high-speed, rear-dump, 16-ton C Tournarockers. Teamed with a 1½-yd. shovel, each "C" carries 10 pay yards of high-void broken rock per load . . . up to 15 loose yards of common earth per trip . . . makes a 3-mile cycle of load,

haul, dump and return every 18 to 19 minutes. In a typical 9-hour day, each Tournarocker delivers 25 loads over rutted, steep ground to the dump . . . in a 7-hour day on this length haul, figures show each "C" moves 18 to 19 loads. That's a total average production for the 2 rigs of 51 to 56 pay yards of rock per hour . . . 75 to 80 loose yards of common earth hourly.

"We're very well satisfied," says Supt. John T. Fox. He also stated that Tournarockers have been about 95% efficient under these difficult job conditions.

Visit Newbury...see for yourself

If you're near Newbury, by all means visit this job. See for yourself what job-proved 33 m.p.h. Tournarockers can do for you . . . or ask your local LeTourneau Distributor for facts and figures on work like yours.

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PEORIA, ILLINOIS

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There is a HAZARD distributor near you to serve you with this premium brand of wire rope.



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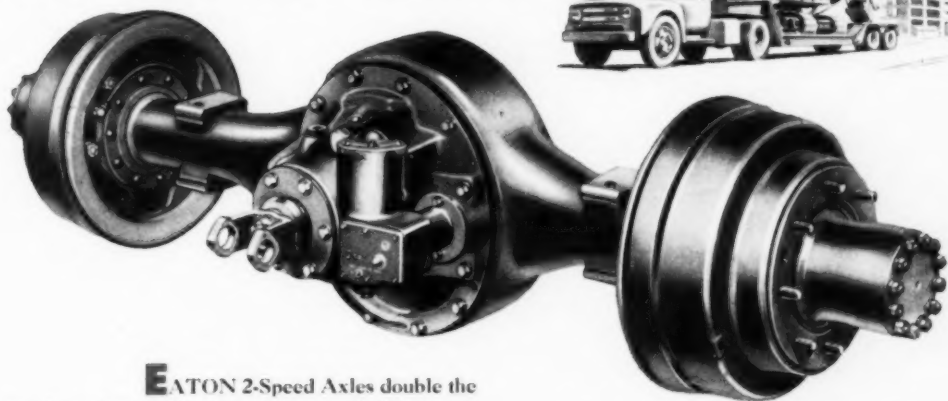


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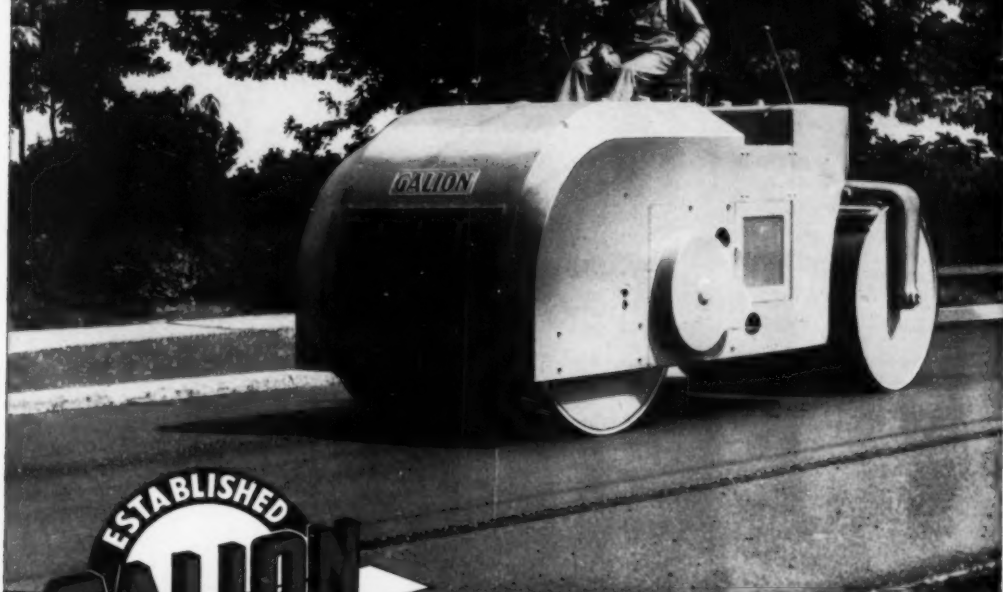
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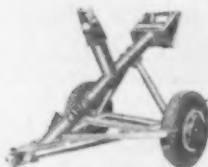
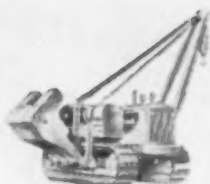
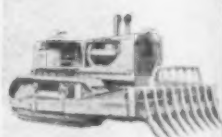
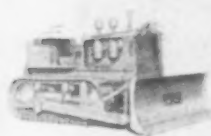


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- 1 Model 101 Portable Asphalt Plant consisting of a drier, dust collector, and combination gradation-mixing unit.
- 1 Auxiliary drier.
- 2 2-Unit Portable Plants each consisting of a 150 PG Primary and 140S Secondary.
- 2 40 V Duplex Portable Crushing Plants.
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K110

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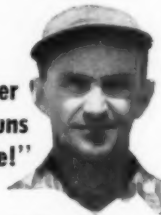
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Mr. Geeting was one of over 250 Heavy Construction Men, shown on pages 43 to 46, who took part in the Run. His Ford F-6 Dump traveled 21,003 miles at a cost of \$639.83 for gas, oil, maintenance and repairs. Check your truck running costs with those of other heavy construction men whose loads and working conditions are similar to yours!

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AT YOUR FINGER TIPS...

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Introduced 15 years ago, Speed-o-Matic power-hy-

draulic controls have proved their superiority under toughest field conditions. They are typical of the many advanced features, such as the optional independent swing and travel, which make the LS-51 the standout performer of the 1/2-yard field. Other Link-Belt Speeder models are available in shovel capacities up to 3 yards; cranes up to 60 tons, in crawler, truck and wheel-mounted types. Each model is fully and quickly convertible to all Shovel-Crane attachments. Prompt service is provided by a nation-wide network of factory-trained distributor servicemen.

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A big, rugged machine (weighing up to 27,000 lbs.), the No. 610 is engineered to utilize the full torque of its 100-hp. diesel engine—in *all gears*. It's a machine that carries the punch and rugged staying power to tackle and whip biggest, roughest grading jobs.

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Large, Wide-Tread Tires—for maximum traction and flotation.

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Extra Wide Blade (28 in.)—to utilize the great capacity of the No. 610.

Let your local Adams dealer give you complete information on the No. 610—the greatest of all heavy-duty motor graders.

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*Make your next
motor grader an*

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"AT HUNGRY HORSE ONLY 6 TEXACO PRODUCTS HANDLED ALL OUR MAJOR LUBRICATION"



BUILDING HUNGRY HORSE DAM, HUNGRY HORSE, MONTANA: Equipment used included 24 Diesel-powered Euclids, each of which has logged a quarter-million miles on this assignment; 9 Caterpillar tractors; 5 Northwest shovels; 27 International Harvester trucks; 8 Reo 55-passenger buses—plus numerous Chicago Pneumatic and Gardner-Denver air compressors and Chicago Pneumatic rock drills, as well as 2 Lidgerwood Cableways and 2 Washington Cableways.



General-Shea-Morrison Company, Contractor,
Hungry Horse Dam, Hungry Horse, Montana, says—

**"The time and confusion saved by the Texaco
Simplified Lubrication Plan are incalculable."**

"Not only is it more economical to use a small number of lubricants," says General-Shea-Morrison Company, "but there is little chance of error in application. The Texaco Lubricants used at Hungry Horse Dam were a big factor in keeping our equipment on the job and keeping our maintenance costs low."

Products Used in Texaco Simplified Lubrication Plan

1. ENGINE LUBRICATION: Use *Texaco Ursa Oil X***. Fully detergent-dispersive, keeps heavy-duty gasoline and Diesel engines clean, keeps harmful deposits from forming, guards against wear, rust, corrosion. Reduces maintenance costs and fuel consumption. **2. CHASSIS LUBRICATION:** Use *Texaco Marfak*. It's tough, longer lasting. Won't jar or squeeze out, protects against dirt, rust, wear. *More than 400 million pounds sold.* **3. WHEEL BEARING LUBRICATION:** Use *Texaco Marfak Heavy Duty*. Seals out dirt and moisture, seals itself

in, assuring longer bearing life, safer braking. No seasonal change required. **4. CRAWLER TRACK LUBRICATION:** Use *Texaco Track Roll Lubricant*. Gives long-lasting protection against dirt, water, wear. Reduces maintenance costs. **5. AIR COMPRESSOR LUBRICATION:** Use recommended Texaco air compressor oils. There is one exactly suited to your operating conditions. **6. ROCK DRILL LUBRICATION:** Use *Texaco Rock Drill Lubricant EP*. "Extreme pressure" properties give superior protection against wear. Guard against rust whether drills are running or idle.

Follow the Texaco Simplified Lubrication Plan for greater savings and convenience. A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

Bridge Raised Under Traffic

in "Flood Proofing" Program for Ohio River Road

Traffic maintenance with aid of traffic signals an important item in operation here described

THE Ohio River Road entering Portsmouth from the West carries extremely heavy traffic from Cincinnati and other Southwestern Ohio points, via routes U.S. 52 and converging state routes. How to insure traffic against stoppage by the Ohio River's periodic floods, where the road crosses the river flats into Portsmouth, has long been a problem. Several times in recent years the city has been cut off from this route.

Economic studies of various raising and relocation schemes, some of which included emergency ferry service during extreme floods, were made by the Ohio department of highways. The result was to prove the economic justification of a project for relocating the approach on a new high-level grade, and of raising the adjacent 2-lane bridge over the mouth of the Scioto River.

The relocation, which has several interesting features, will be described in a separate article. This report covers only the bridge raising.

The Scioto River bridge here consisted of three 336-ft. through truss spans and a 75-ft. east approach span. The bridge was on a grade of 0.6% for the three west spans, the remainder being level. The structure on the east or Portsmouth end is at an elevation above the 60 ft. flood level, for which the new west approach roadway location was designed. The west end of the bridge, however, dipped down to the old river-flat approach. A major part of the highway scheme here, hence, consisted of raising the three west spans (sketch).

The plans adopted called for raising the west abutment 4'3" and the two western piers respectively 2'3" and 1'0" in order to bring the entire bridge to a virtually level profile.

A new 65-ft. I-beam span was to be added at the west or raised end, to increase the waterway, and a temporary ramp built to take traffic down onto the existing roadway while the new high roadway was being completed. A subcontract awarded to American Bridge Company included structural steel, raising and painting. A sub-contract for repair and strengthening of the floor system, renewal of sidewalk supports, new guard rail, and construction of the new span was given to Geo. A. Stine Contracting Co., of Chillicothe, both subcontracts being with Carl Myers

& Co., and W. H. Ringwald & Sons Co., of Columbus, Ohio, joint prime contractors for the road project.

The contractor was required to submit and receive advance approval of the scheme for performing all removal and construction work and maintaining traffic.

Bridge Raising Method

The raising scheme adopted was as follows:

1. A system of I-beam grillages each 4 ft. square was designed for piers 5, 4, and 3 as sketched.

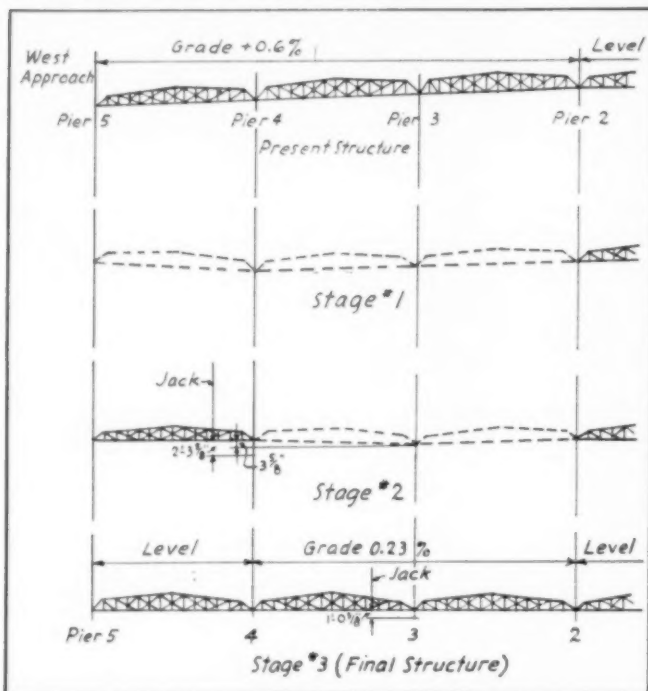
2. Pier 5 (west abutment) was first to be raised, this work involving removal of the backwall and construction of the temporary ramp off the bridge, using graded crushed slag which required no rolling. The actual raising was performed by means of four 100-ton hydraulic jacks operated as a system by the hook-up here sketched. The jacks rested on the pier top adjacent to the bridge shoes, and

★ A jack raising operation is in progress here. Note pair of jacks under each end post, with a steel stress distribution plate under base of jacking bracket





★ Pictures taken during the raising of the west abutment (Pier 5). At left, jacks in position on blocking. At right, new grillage under bridge shoe has been encased in concrete



lifted the span with the aid of temporary I-beam jacking brackets bolted on the under side of the end posts (also sketched).

As noted in the accompanying photos two jacks under each end post were used in conjunction with a 3-in.-thick steel jacking plate to distribute load stresses. Raising was done in a series of 8 in. lifts approximately. Timber and I-beam cribbing was used to raise the jack supports.

3. The jacking operation was repeated next at pier No. 4, two sets of four raising jacks being operated to simultaneously raise the two truss ends.

4. The trusses were similarly raised at pier No. 3.

5. The grillages were then encased in concrete, and the raising phase of the job completed.

6. The abutment and deck for the new approach span built were con-

★ Showing how raising was accomplished, beginning at Pier 5 and completing the full raise at each pier before going to the next

★ (Left below): A view of the hydraulic pump, hookup of which is shown in the accompanying sketch

35

★ Bridge has been raised and a ramp constructed of slag, pending construction of a new approach span



structed half width at a time, one-way traffic being maintained on the undisturbed side of the temporary ramp during the first half, and diverted onto the new span and thence down a temporary ramp for the second half, until finally the full roadway ramped off the new span pending completion of the high-level approach.

Traffic Maintenance

The raising item in the prime contract bid was \$11,500. More costly in the entire road and bridge project was the item of \$27,000 for traffic maintenance during construction. This figure was large because of the heavy (10,000 daily) traffic count, with morning and evening peaks, and also because the entire project including several miles of grading would require more than a year of flagmen service of some kind. [Ohio is among the states which today recognize the growing importance of traffic maintenance and accident prevention along the work, and this phase is made the contractor's responsibility with provision for payment as a contract bid item. Editor].

The most interesting and difficult phase of traffic maintenance here was on the bridge and approaches during the raising and bridge repair work.

An electric red-green traffic light was located on the bridge at a beginning point of the raising work. Another light was located just off the bridge. A flagman in addition was posted at either or both lights, as

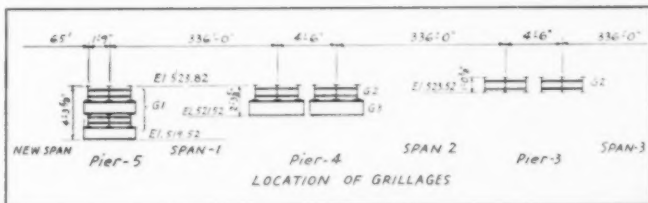
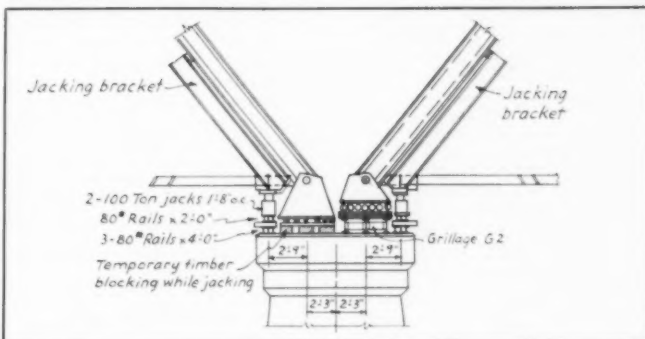
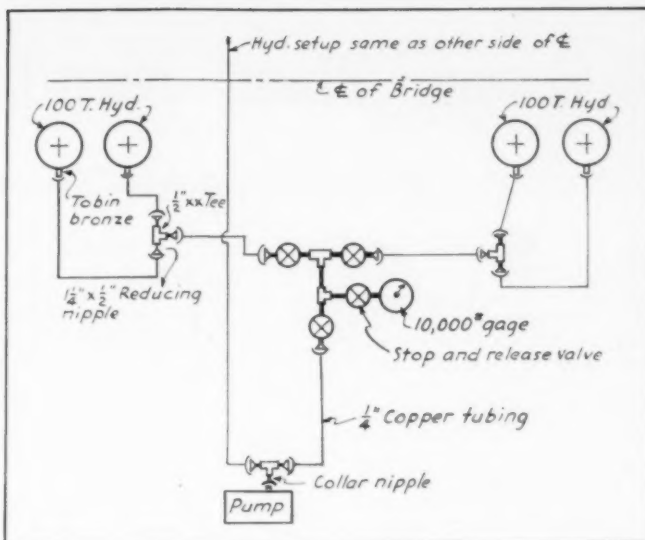
(Continued on page 85)

★ How the four jacks were set up hydraulically for simultaneous operation

★ Jacking bracket details and position of jack

★ Details of grillages used in the raising

★ (Left) Electric stop-and-go light posted at entrance to bridge, to guide traffic during raising operations. (Right) A similar light located on the bridge just beyond the work of raising.



Highway "Plant" Must be Maintained

Keynote of AASHO Meeting at Omaha

New facts given on growth and economic importance of highway transportation, and on need for large-scale, long-range programs of highway reconstruction and intensified maintenance. Panel discussions and committee meetings on many topics were geared to defense emergency

SOME gloom and also much optimism and militant courage over the highway outlook were voiced at the Omaha convention of the American Association of State Highway Officials. The meeting, held October 22-26, as usual brought together top highway officials and engineers from the 48 states, Hawaii, Alaska, the D. of C., Puerto Rico, and the U.S. Bureau of Public Roads. Also present were several hundred visitors including consulting engineers, county and municipal liaison men, representatives from contracting, from trucking and other user groups, and—most important—members of the U.S. Senate, House of Representatives, and federal agencies concerned with highway and defense problems.

Steel Situation

Estimating the immediate total shortage of steel for highway projects at 122,507 tons, commissioner of public roads Thos. H. MacDonald noted that the number of projects delayed by the steel shortage has increased from 319 in August to 680 as of October 5. For the immediate future, said the commissioner, it is apparent that the highway rehabilitation program will be limited severely, principally by the availability of steel.

MacDonald and other leaders however gave new emphasis to the economic urgency of continuing with long-range, high-level programs of road betterment and repair, as a public necessity in peace or war.

The steel outlook is "brighter than it was", is the position taken by one speaker, Delos W. Rentzel, undersecretary of commerce for transportation. While the first quarter of 1952 will see a continued squeeze on highway steel, he noted that the materials outlook is "much brighter than it was several weeks ago." He stressed a sure conviction that the steel shortage

would ease up after next July. During the last half of 1951 the steel allocations for highways, short as they were of need, meant little since only a trickle of steel of certain types could be located for purchase.

The waste in time and loss of national productive capacity, due to inadequate highway facilities, is particularly acute in urban areas, reported Commissioner MacDonald. The recently stepped-up urban programs call for an average expenditure of \$17 for steel (largely structures) for each \$100 of construction cost, compared with only \$8.50 on primary and \$5.60 on secondary road projects.

For the past 10 years the rate of rehabilitation of roads has averaged far less than the rate required to keep the system in reasonably good repair. The accumulated deficiency is now 74,000 miles of main roads, and is increasing by 5,000 to 6,000 miles a year. This analysis doesn't take into account growing obsolescence due to increased

Technical Sessions

See next month's issue of ROADS & STREETS for notes on panel discussions and committee meetings at the Omaha AASHO convention.

traffic nor the rapid deterioration due to large volume of heavy loads. This would make the mileage of deficiencies about three times as large.

Senator Thos. C. Hennings, Jr., of Missouri, a member of the Senate subcommittee on roads, emphasized the strategic importance of roads to national defense, and suggested that some effort be made to determine priorities for steel and other critical materials among projects in the different states.

Anderson Reviews Problems

Not too many of our problems in highway work are new, noted J. A. Anderson, of Virginia, AASHO retiring president, in his annual address. Most of our problems are from one to ten years old, he said. For twelve years we have been preparing for war, waging war, or trying to recover from war, and are no strangers to increased effort and strain.

"No state has at its command a more disciplined, loyal, trained and efficient organization than its highway department," said Mr. Anderson. "In times of emergency or disaster, it is available at once, its staff dispersed and ready, its men and women of the highest character, integrity and loyalty. Their worth within the state and the nation should be periodically evaluated, and rewarded.

"So long as we keep up a strong highway transport, that long shall we remain strong and free. Our leaders in the highway field are determined that the essential role of highway transport shall not be overlooked or cast aside. When materials and equipment are sorely needed, we will not take 'no' for an answer."

Problems Polled

A nation-wide poll of highway departments indicated many major problems (Continued on page 90)

Tallamy to Head AASHO in '52

Elected to head the American Association of State Highway Officials for the coming year:

President: B. D. Tallamy, Superintendent of Public Works, New York state.

1st Vice President: Charles F. Ziegler, Highway Commissioner, Michigan.

Regional Vice Presidents: T. J. Kauer, Director of Highways, Ohio (re-elected); Mark Watrous, State Highway Engineer, Colorado; Frank Merrill, Commissioner of Highways, New Hampshire; Gerry Pruitt, Director of Highways, Alabama.

Executive - Committee (newly-elected or ex-officio, not including held-over members): J. A. Anderson, Virginia (ex-officio, immediate past president); D. C. Greer, Texas (past president); G. T. McCoy, California (succeeds C. H. Purcell, deceased); P. H. Kitfield, Massachusetts; F. R. White, Iowa; R. F. Smock.

Treasurer: C. H. Henderson, Rhode Island.

Executive Secretary: Hal H. Hale, Washington, D. C.

Industry Backing of Road Building Gives New Promise of Continued Highway Transportation Growth

It has begun to happen at last. Industrial leaders have awakened to the need for better highways and are getting behind the idea with the power of their advertising and promotional programs.

Recently the trucking industry has changed noticeably from obstructionist tactics to a position of advocating the construction of stronger and more modern roadbeds vital to the nation's highway transportation. And then came the Goodyear Tire & Rubber Company with an advertising campaign which has rung the bell. This campaign, we understand, will run for a long time and is not a passing fancy but the result of official cognizance of a growing highway inadequacy that eventually will stifle automotive industry growth unless corrected.

Virtually the entire American population will have read the Goodyear message or the editorials in newspapers and magazines which will be inspired by this campaign. The first ad which hit the newsstands late in September had an impact which has not been equalled in any publicity in behalf of roads to our knowledge for a long time.

The Ford Motor Company joined the roads push with striking 2-page newspaper ads in certain cities. Firestone came out with big newspaper ads on the need for better roads to reduce accidents.

Also among the industry giants to launch a good roads campaign was General Motors. In Mid-October this company inaugurated a nation-wide program, through its "grass roots" dealers, featuring a GM movie, "Let's Get Out of the Muddle," a compelling pictorial booklet which will be circulated in the millions, and widespread newspaper publicity.

GM Analyzes "Muddle"

The GM movie, narrated by John Daly, noted foreign correspondent and radio and television commentator, points to seven reasons we are in our present "highway muddle." They are:

(1) Many of our existing highways are dying of old age. Their number is up.

(2) During World War II we unwisely considered highways "expendable" and, as a result, let many of them go to pot. Last year alone more than a billion dollars was spent in a "desperate effort to keep existing roads in service." Much of this sum could have been used for necessary new construction if we had not let our roads deteriorate so badly during the war.

(3) Inflation has taken about 50 cents out of the 1941 highway construction dollar.

(4) In the past 10 years population has increased more than 19 million; spendable income has increased about 130 billion dollars. Vehicle registration has increased from 33 million to more than 48,000,000; mileage traveled, from 300 billion to 450 billion a year.

(5) Our highways were built for yesterday.

(6) We have permitted our city streets to become bottlenecks and have done little to develop them into systems designed to meet the requirements of today's motor traffic.

(7) We have not always used our highway tax funds wisely. We have spent highway tax money for other purposes, thus reducing the funds available for road building.

Users Paying Peanuts

The purpose of the GM program, "to urge rehabilitation and modernization of our city and national highway system," must finally be translated by state and national legislators into new laws which assure sound administrative machinery as well as increased taxation on an equitable basis.

For every dollar the American motorist spends for owning and operating his vehicle he only spends 6½¢ for gasoline taxes. We are still shelling out only peanuts to enjoy the privilege of having good roads and streets under our cars, trucks and buses. The curse of this business is the state lawmaking body made up of men who seem to be scared of their shadows. What could be made more politically popular, if the real facts were brought out, than a platform of roadbuilding which will help transform the social and economic lives of the voters? It would cost the voters only a few pennies per day additional—a painless deal and a bargain for which they would surely be glad to pay.

The immediate problems of securing steel for essential highway projects, and of getting breaks for road building in Washington, should not cloud the main problem which is to crusade by every legitimate means for a continuation of highway construction in this country on an ever expanding scale as a matter of public necessity. The No. 1 job is to present state legislatures with factual data which will encourage them to create better highway administrative machinery, find new highway revenues, and eliminate the diversion of present highway revenues to non-highway purposes.

IT COSTS LESS TO BUILD GOOD ROADS THAN TO HAVE POOR ROADS

DESIGN AND CONSTRUCTION OF A

Relocation for Heavy Traffic

The West Virginia State Road Commission's latest ideas in geometric design, traffic evaluation, flexible and rigid pavement design, and field testing of subgrades, are here described as applied to the most modern and heavily designed arterial highway the state has ever undertaken.

By R. F. Baker

Engineer of Soil Mechanics, State Road Commission of Charleston, West Virginia

USING the highest geometric design standards, the most advanced slope designs, and the heaviest flexible pavement ever employed for a two-lane road in West Virginia, a relocation on US 21 north of Charleston is scheduled for completion in 1951. Known as the Ripley-Fairplain Project this five miles of construction will take the kinks out of a section of the Wheeling-Parkersburg-Charleston traffic axis, one of the more heavily traveled routes in the State, with an average annual 24-hour count of 2500 vehicles, including 800 heavy trucks, in 1949.

The roadway traverses rough terrain for four miles and passes through the top of one ridge where cuts up to 90 ft. and fills to 80 ft. were required. Thanks to about one mile of creek-

bottom location, the excavation amounted to only 780,000 cu.yd. for the five miles. The road is graded 54 ft. wide, shoulder to shoulder. All cuts over 30 ft. in height are benched to minimize the cost of future maintenance in keeping ditches open.

The new road has maximum grades of 5% and only five easy curves, compared to 62 curves, mostly sharp ones, on the old "hill and dale" location which it roughly parallels.

Excavation Problems

As is typical of West Virginia, very little soil was encountered in the excavation. However, extensive shale formations were sufficiently soft so as to be handled as soil. Some soft sandstone and hard shales required blasting. Specifications permitted 3-ft. layers in this latter material. The bulk of the excavation, however, was placed in the 8-in. lifts required for soil and soft shales. The material ranged in classification from A-4(5)

to A-7-5(11), contained approximately 35% to 45% clay, a P. I. of 8 to 16, a standard maximum density of 105 to 112 lb. per cu.ft. and an optimum moisture content of 15% to 21%. Field density tests were conducted regularly by District personnel. Specifications required compaction be such that a density of 95% of the laboratory maximum density (AASHTO standard) be obtained. The field tests showed results ranging from 95% to 105%.

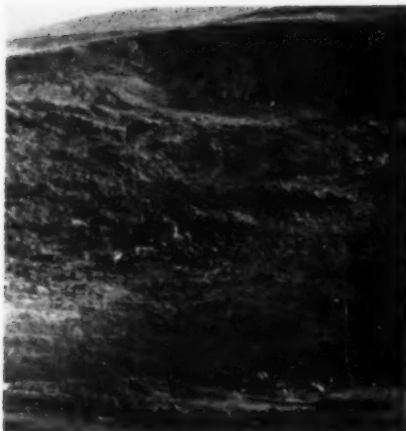
For the difficult terrain involved, the excavation was completed in near-record time. The grading contract was awarded in July, 1949, to Keeley Construction Company of Clarksburg, West Virginia. By December, 650,000 cu.yd. had been moved. During the month of August, 160,000 cu.yd. were completed.

Design of Cut Slopes

At the conclusion of part of the rough grading, drastic action was deemed necessary to minimize future maintenance costs due to the weathering of the shale slopes. The original design called for 1½:1 slopes in the shale-sandstone areas. Figure 1 shows one such cut the Spring following its excavation. As a result of this extensive weathering, all of the slopes



★ How a winding, twisting road was straightened is dramatically shown in this picture—62 curves reduced to 5 on this West Virginia project



★ Fig. 1. This shale slope was excavated on a slope of $1\frac{1}{2}:1$ and after one winter looked like this



★ Fig. 2. Same excavation, shown in an adjoining scene, after benches had been placed

on the project were reconsidered, and the slope pictured in Figure 1 now appears as shown in Figure 2.

The new West Virginia standard design for Primary Roads will follow generally this same slope pattern, a diagrammatic sketch of which is shown in Figure 3. The principle involved with the use of the benches is not to produce an area to serve as a "catch-all" and subsequently to be cleared off. The theory suggested is that the benches will serve to catch the weathered material and produce an "insulator" to the unweathered material. It has become obvious in West Virginia that to continually remove the debris from the ditchline or bench means to continually expose new material to be weathered and subsequently removed.

The design standard suggested in Figure 3 is for areas of undisturbed shale formations. Somewhat different standards are employed in sandstone and limestone excavations. However, some type of bench is recommended except in cases of sandstone and limestone which are not subject to rapid weathering or exfoliation. The quantities of excavation are not materially affected if the alternate is a realistic slope design. The slope above the benches can be steeper than would be desirable without a bench, since some degree of weathering of the rock formation will take place regardless of the flatness of the slope.

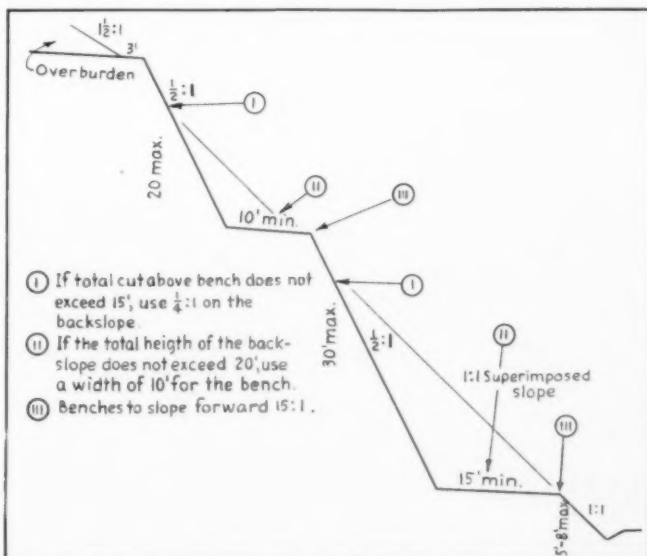
The project was considered initially with a view to selecting areas considered as having similar subgrade conditions, and five sites for bearing tests were determined as adequately representing the variations in the project. The typical locations varied in type of cross-section as well as soil

conditions. Figures 4 and 5 show the location and type of section at each of the sites.

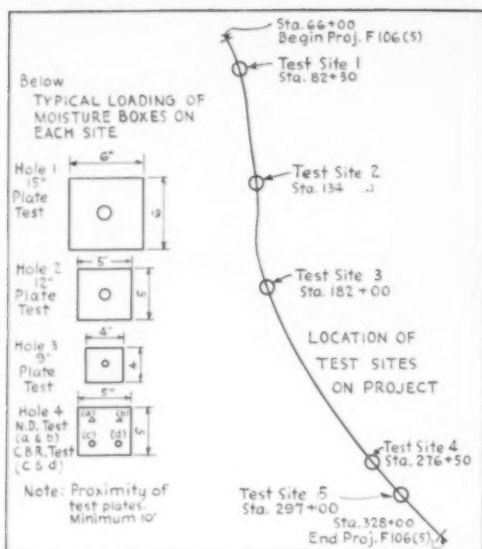
Field density determinations were made along the approximately finished grade at 500-ft. intervals. Small samples were brought into the Laboratory and the routine classification test performed. This was done in order to determine whether the project could be divided into soil areas with different thicknesses of base for the various areas. Table IV is a summary of these data. A study of the table and the results of the bearing tests did not indicate any practical

value in dividing the project, insofar as thickness of base was concerned.

Alternate designs were contemplated for flexible and rigid pavements. The basis for the flexible pavement design was Bulletin No. 13, dated September, 1949, Engineering Experiment Station, University of Kentucky, titled "Investigation of Field and Laboratory Methods for Evaluating Subgrade Support in the Design of Highway Flexible Pavements." The basis for the concrete design was the manual published in 1946 by the Portland Cement Association, titled "Concrete Pavement Design" and



★ Fig. 3. Typical design of major cuts in shale, West Virginia class 1a. Cuts exceeding 20 ft. and above average weathering are indicated here



★ Fig. 4. Results of a typical bearing test on the project described

which utilizes Westergaard's formula.

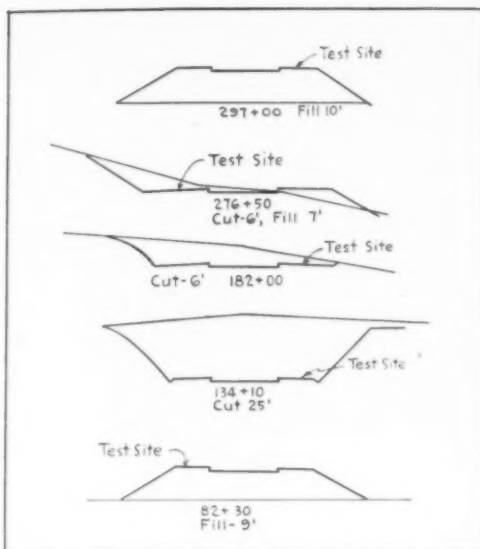
Subgrade Field Tests

For this first series of tests in West Virginia the Field C.B.R., North Dakota Cone, and the Bearing Plate Tests were used. The equipment was made available through the courtesy of the Research Division of the Kentucky Department of Highways, and the Research Bureau of the Virginia Department of Highways. The procedures used were quite similar to those outlined in Bulletin No. 13, mentioned above.

The main difficulty in any flexible or rigid pavement design is the fact that the moisture content of the subgrade is a critical factor and is most

difficult to evaluate. However, it is now generally accepted that over a period of a few years the moisture content in the soil beneath a pavement will increase and some engineers believe it will approach the plastic limit of the soil. In order to get this condition, boxes of sand were prepared at the sites to be tested. Figure 6 illustrates the soaking arrangement. The sand was kept saturated for at least one week.

When the moisture content of the subgrade approximated the plastic limit, the field tests were conducted. Figure 7 illustrates the cone test. Loads in increments of 10, 20, 40 and 80 lb. were applied through the plate and rod arrangement. The penetra-



★ Fig. 5. Cross sections of bearing test sites of the Ripley-Fairplain project

tion of the cone into the subgrade was measured on the extensometer dial. The test is essentially a point bearing, empirical type of test.

In Figure 8 the Field C.B.R. test is shown. This test consists of loading a 3 sq. in. disc (approximately 2 in. diameter) and measuring its penetration into the subgrade. The load was applied with a hydraulic jack and measured with a pressure gauge. Penetration was measured with an additional dial. This is essentially a bearing test on a small area and the results are applied in an empirical fashion.

Further bearing plate tests were run, using plates of 9, 12 and 15 in. diameter. The method of loading and the system for measuring penetration were the same as for the Field C.B.R. In Figure 8 the load is shown being applied against the bumper of a 1/2-ton truck, whereas for the plate tests an I-beam arrangement was used under a loaded dump-truck. The beam ends are jacked so that the rear wheels of the vehicle clear the ground. This places all of the weight of the rear of the truck on the beam.

The method of computation for the cone test is outlined in the A.S.T.M. Publication, "Procedures for Testing Soils," 1950. A typical set of computations for the Field C.B.R. is shown in Figure 9. This gives test data from Test Site No. 1 and shows a minimum C.B.R. of 10.

Computations for the Bearing Plates are shown in Figure 10 where the total load is plotted versus deflec-



★ Fig. 6. Arrangement for obtaining a near-saturated subgrade



★ Fig. 7. Apparatus in place for the North Dakota Cone Test

tion. For the flexible pavement design, the load required to produce 0.1 in. deflection was obtained for each of the three plates. This load was converted into unit loading and plotted versus the perimeter-area ratio in Figure 11. Theories advanced by Professor Housel* indicate that for clay soils a straight line should



★ Fig. 8. Apparatus in place for the field C.B.R. test

result from this latter plotting and that the line can be projected to any sized plate desired. The data in Figure 11 verify this theory and the line was projected to the P/A for a 30-in. diameter plate. The perime-

ter-area theory permits the use of smaller plates and as a consequence smaller loads and equipment. In this instance it was possible to estimate the bearing capacity under a 30-in. plate, although nothing larger than a 15-in. plate was used. This projection to a 30-in. diameter plate was also estimated for a deflection of .05

* W. S. Housel, "Design of Flexible Surfaces"; Proceedings, 23rd Annual Highway Conference, University of Michigan, 1937.

Table I

Site Number	Per Cent M.C. Average	Test Number	10"	20"	40"	80"	PSI Average for Test	PSI Average for Site	Test 1	Test 2	Average	Per Cent M.C. Average	12" 0.1" Penetration PSI	30" 0.1" Penetration PSI	30" .05" Penetration PSI
I.	14	1	313	344	338	344	342	323	9.6	9.4	9.5	24	19	8	5
		2	306	304	305	303	304								
II.	16	1	227	171	178	171	173	189	4.0	4.0	4.5	16	34	32	16
		2	306	212	186	215	206								
		1	458	456	491	457	468*								
III.	23	2	325	265	265	265	265	272	4.2	4.6	4.4	20	33	29	6
		3	439	279	283	279	280								
IV.	15	1	322	195	205	196	199	153	3.3	4.2	3.8	22	13	6	8
		2	123	106	108	106	107								
		1	128	143	172	142	152*								
V.	19	2	755	616	644	618	626	415	7.0	8.5	7.8	18	25	14	8
		3	567	470	464	471	468								

*Excluded from Averages.

Table II

Estimated Number of Axles per Day in Each Load Group For All Vehicle Types (Loaded & Empty)
U.S. 21 South of Ripley, Jackson County, W. Va.

E.W.L. Factor	Axle Load Pounds	1950		1955		1960		1965		1970	
		E.W.L.	No. Axles	E.W.L.	No. Axles	E.W.L.	No. Axles	E.W.L.	No. Axles	E.W.L.	No. Axles
	Under 9000		2306		4101		4475		4856		5236
1	9000-11000	95	95	104	108	119	119	128	128	139	139
2	11000-13000	106	53	146	73	180	90	212	106	242	121
4	13000-15000	240	60	344	86	428	107	500	125	568	142
8	15000-17000	544	68	848	106	1104	138	1328	168	1512	189
16	17000-19000	1724	124	2624	164	3152	197	3648	228	4112	257
32	19000-21000	1728	54	1696	53	1280	40	800	25	416	13
64	21000-23000	220	5	384	6	384	6	256	4	128	2
128	23000-25000	256	2	256	2	256	2	128	1	128	1
	25000-27000										
	27000-29000										
	Totals	5213	3977	6406	4699	6903	5174	7000	5641	7245	6100
	Total for 1950-1951				2,000,000						48,000,000
	Total for 20-year period										

Table III. Pavement Thickness Required (Total Base & Surface)

SITE	N.D. Cone		Field CBR		12" Plate		36" Plate		Average	
	1 YR.	20 YR.	1 YR.	20 YR.	1 YR.	20 YR.	1 YR.	20 YR.	1 YR.	20 YR.
1	11"	21"	10"	15"	10"	21"	10"	20"	10"	19"
2	13"	22"	12"	17"	8"	16"	7"	11"	10"	18"
3	12"	22"	13"	17"	8"	16"	7"	12"	10"	18"
4	14"	22"	13"	18"	11"	23"	11"	21"	12"	21"
5	10"	19"	11"	16"	9"	19"	9"	18"	10"	18"

* Excluded from average.

Table IV. Station-by-Station Field and Laboratory Test Results

Station	Plasticity Index P.I.	Liquid Limit L.L.	H.R.R. Classification	Field Density Lbs./Cu.Ft.
68 + 50	8	28	A-4(6)	118.8
74 + 00	10	32	A-4(7)	117.4
79 + 25	NO TEST			108.9
84 + 25	11	32	A-6(7)	121.0
89 + 25	10	30	A-4(6)	112.2
94 + 50	12	31	A-6(7)	124.4
115 + 25	12	31	A-6(7)	119.9
121 + 00	10	37	A-4(8)	118.8
126 + 00	12	32	A-6(7)	103.4
131 + 00	16	35	A-6(9)	123.2
136 + 00	12	34.5	A-6(8)	118.8
141 + 00	13	32	A-6(7)	121.0
146 + 00	NO TEST			101.2
151 + 50	10	36	A-4(8)	123.2
157 + 50	8	32	A-4(6)	124.3
162 + 00	14	37	A-6(9)	114.4
167 + 00	14	37	A-6(9)	125.4
171 + 50	9	35	A-4(7)	123.2
177 + 00	14	42	A-7-5(10)	123.2
182 + 00	13	31	A-6(7)	112.2
187 + 00	16	43	A-7-6(11)	106.7
192 + 00	NO TEST			114.4
197 + 50	6	33	A-4(7)	121.0
202 + 50	NO TEST			125.4
207 + 00	11	35	A-6(7)	111.5
212 + 50	11	35	A-6(8)	112.2
217 + 50	6	26	A-4(5)	115.5
222 + 50	NO TEST			116.6
227 + 50	10	35	A-4(7)	112.2
232 + 50	11	29	A-6(6)	118.8
237 + 50	14	35	A-6(9)	121.0
242 + 50	15	35	A-6(7)	115.5
247 + 50	12	38	A-6(8)	116.6
252 + 50	15	35	A-6(9)	117.7
257 + 50	12	36	A-6(8)	116.6
263 + 00	10	33	A-4(6)	122.1
268 + 50	9	30	A-4(6)	127.6
273 + 50	NO TEST			125.4
278 + 50	NO TEST			129.8
283 + 50	NO TEST			ON ROCK
288 + 50	9	31	A-4(6)	114.4
293 + 50	10	25	A-4(5)	127.6
299 + 00	8	32	A-4(6)	126.5
326 + 50	NO TEST			117.7

Table V. Summary of Concrete Design Data

Site No.	K*** Factor	W (Wheel Load)	D** (Depth)	S***
1	100	9,000	7.4	350
2	350	10,500	8.00	350
		9,000	6.75	350
3	125	12,500	8.00	350
		9,000	7.3	350
4	150	10,750	8.00	350
		9,000	7.2	350
		11,000	8.00	350
5	170	9,000	7.1	350
		11,650	8.00	350

* Determined from 30" circular plate loading as interpreted from relationship between bearing capacity and perimeter area ratio.

** 20% impact factor and a uniform thickness.

*** Modulus of Rupture for concrete assumed to be 700. A safety factor of 2 was applied.

in, in order to determine the K-value for designing the concrete pavement. These data are contained in Figure 12.

The foregoing is an extremely brief resume of methods employed. The

theories are detailed and well outlined elsewhere.

In Table I there is a summary of the values obtained for subgrade support. This table lists the values needed in order to design a flexible

pavement by the methods chosen.

Traffic Evaluation Method

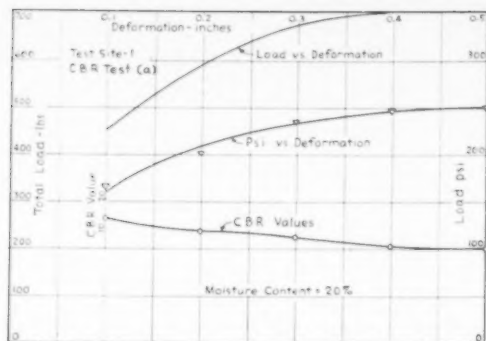
The two main factors in designing a pavement thickness are the subgrade support and the traffic. Without an estimate of the loads to be applied, a good estimate of pavement thickness cannot be made. Through the effort of the Commission's Planning Division, Table II was prepared. It shows the predicted number of axle loads of various magnitudes for the twenty year period, 1950-1970. To obtain the data, past records were projected into the future. This was done for each of the various axle loads. It should be stated that the accuracy of the values obtained was considered questionable by the Planning Division Engineers due to the lack of past data. Extreme accuracy is not considered vital, however. A close look at the design data will show that in the higher values for Equivalent Wheel Loads (E.W.L.), very little difference in required pavement thickness is made by doubling the total E.W.L.

The basis for the equivalent wheel load is a theoretical analysis applied to rigid pavements. The theory was originally developed for the use of the California Department of Highways. In their analysis it was found that a 6-ton axle was approximately twice as damaging as a 5-ton axle. This progression continues into the heavier loads. Since there was some possibility of placing a temporary surface on the roadway, the E.W.L. was calculated for the first year and found to be 2,000,000. For the 20-year period the total E.W.L. was 48,000,000.

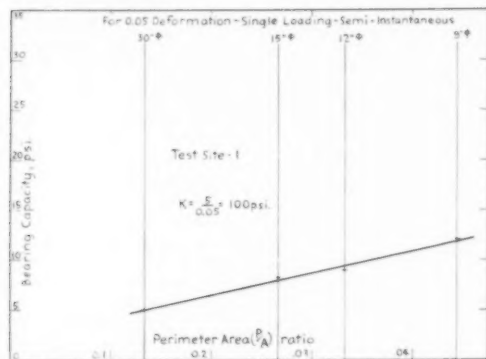
Pavement Thickness Design

In arriving at recommendations for thickness of base, the curves shown in Figures 13, 14, 15, and 16 were used. On the basis of the traffic figures, Curve III was used for determining thickness requirements for the year 1950 and Curve VIII was used for the 20-year period. The curves shown in the above-mentioned figures are the same as contained in Kentucky Bulletin 13, with the exception of Curves VI, VII, and VIII which were extrapolated. This was necessary, since Kentucky's experience had not extended in magnitude to the E.W.L. needed for this project. This is not to infer that traffic conditions are more severe in West Virginia; rather, the original curves were based on past traffic in Kentucky and naturally future traffic will be considerably greater.

In Table III there is a summary of the compacted thickness required at



★ Figure 9—See text

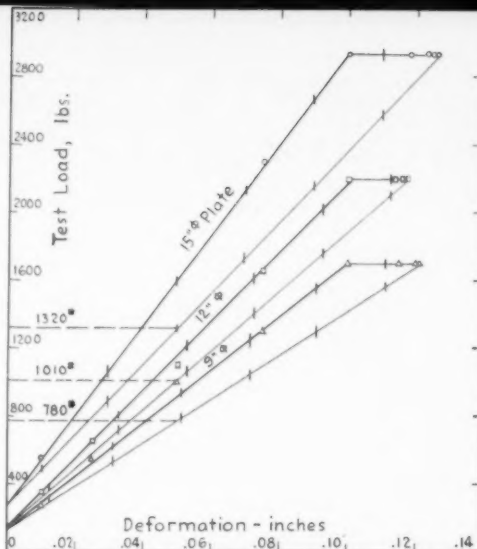


★ Figure 12—See text

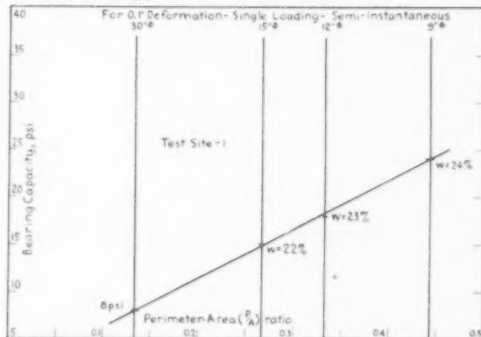
the various test sites. This figure includes total subbase, base and surface. Generally, the thicknesses are comparable, not only between the various test sites but between different tests at the same site. It will be noted that thickness requirements are indicated both for a one-year and a 20-year period. The one-year period was obtained in the event a temporary surface was required.

In addition to general pavement thickness, a critical feature is the design at the edge of the pavement. It is a well-known fact that the load is distributed through the base and that by the time it reaches the subgrade the load intensity is reduced to a value that the subgrade can support. In Figure 17 there is a sketch of a type of pavement section recommended by numerous engineers, including A. T. Goldbeck, in the Crushed Stone Journal, June, 1948. As can be seen, each succeeding layer in depth is extended laterally so that near the edge of the pavement the load gets full lateral distribution. In addition to the theory on lateral distribution, the formula presented by Mr. Goldbeck for a static load was used to

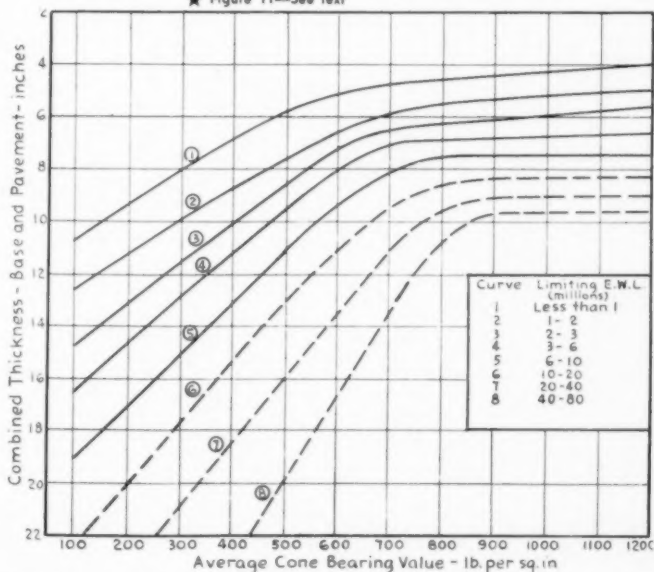
★ Figure 13

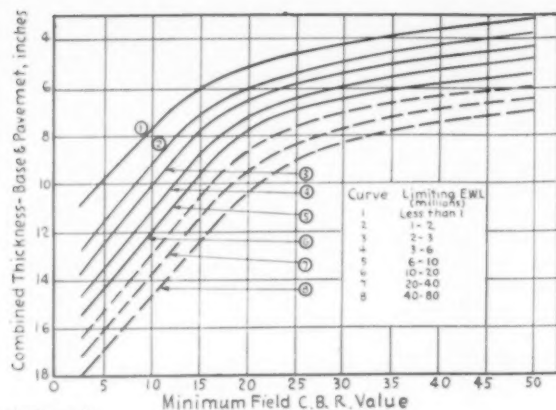


★ Fig. 10. Bearing plate test data—See text

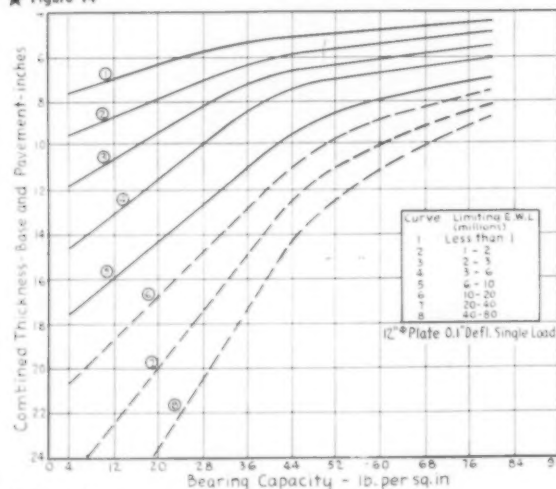


★ Figure 11—See text

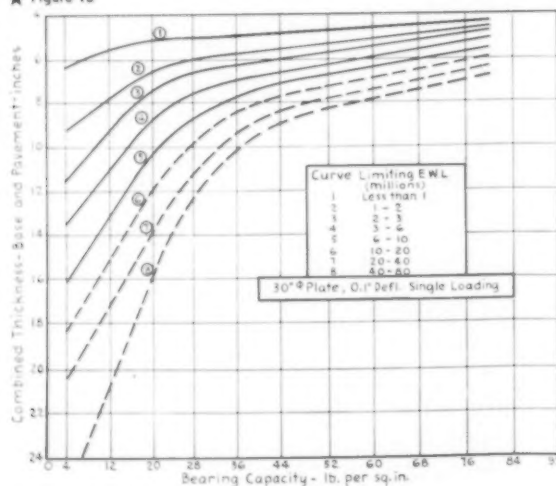




★ Figure 14



★ Figure 15



★ Figure 16

compute thickness requirements for a 12,000-lb. wheel load. The subgrade support factor was estimated from the data from the field tests. The total pavement thickness indicated as necessary was 18-in.

In order to compare the flexible pavement design with a rigid pavement design, Table V was prepared. The figures show that an 8 in. uniform slab would be safe for axle loadings of 11 to 12 tons. No check was made of the possibilities for repetition of heavier axle loads. The methods suggested for such analyses are more open to question than the fundamental design method. It is also interesting to note that for axle loads of 9 tons, approximately 7 in. of concrete would be adequate. The subgrade, by past performance is of the type very susceptible to pumping. For this reason, a 6-in. subbase of river gravel or crusher-run local stone was incorporated into the design. The typical sections which were set up for the alternate rigid and flexible designs are shown in Figures 18(a) and 18(b).

Future Primary Pavement Designs

Although a check on the accuracy of the method employed will not be possible for an extended period of time, the method outlined will be followed with such modifications as appear warranted. For several projects which have combined the grading and paving operations, a preliminary estimate of pavement thickness has been obtained on the basis of laboratory tests on probable subgrade material. Between the final grading operations and the start of paving, field tests will be made on the completed subgrade, and if necessary an adjustment will be made in the thickness of the subbase layer.

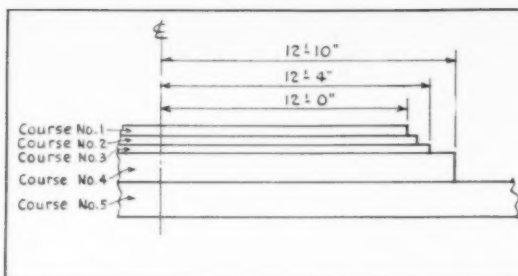
The basis for the laboratory design method is the minimum C.B.R. and the Index value. The C.B.R. is estimated from a statistical analysis of approximately 400 C.B.R. test results compared with other routine soil tests. Designs are also estimated, using the Index value from the H.R.B. Soil Classification, and a set of Curves proposed by Engineers of the Ohio Department of Highways.* The curves are shown in Figures 19 and 20. The two methods have checked remarkably well for similar traffic conditions.

This same laboratory-type design technique is also used for the design of the pavement thickness of all secondary road projects.

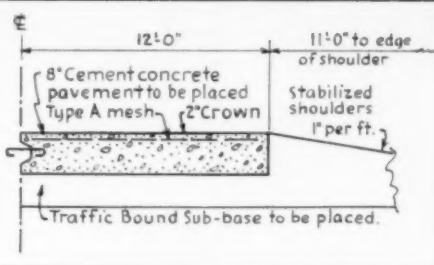
*P. E. Mashetex and H. E. Marshall, "Foundations for Basements", ARBA Proceedings, 1949.



★ Figure 17. Typical design for 1200 lb. wheel load on dual tires. Relatively poor subgrade



★ Figure 18a. Details of base construction, showing how successive layers are pyramided up to give good edge support



★ Figure 18b. Details of alternate concrete pavement design considered

The project was supervised by Ross Kent, Chief Inspector, O. N. Rinehart, District Engineer, and George W. McAlpin, State Construction Engineer. Paul Grass is superintendent for Andersons, Inc., on the paving work, and Jim Rose supervisor of quarry operations.

Flexible Pavement Design U. S. 21, West Virginia

(See Fig. 18a above)

Course No. 1—Asphalt concrete wearing course to be W.Va. Type 1 (modified), consisting of 100 lb. per sq. yd. if stone or gravel aggregate used, or 89 lb. per sq. yd. if slag used.

Course No. 2—Asphalt concrete binder course to be Type 1 (mod.), 200 lb. per sq. yd. if stone or gravel aggregate used or 178 lb. if slag used.

Course No. 3—Penetration macadam base course, to consist of 235 to 250 lb. per sq. yd. if stone or gravel aggregate used, or 209 to 231 lb. if slag used. To be placed full width of pavement at a time.

Course No. 4—Two 3-in. compacted layers of stone macadam base, each layer placed full width at a time.

Course No. 5—One 6-in. compacted layer of crusher-run stone subbase, to be placed full width of grade in one operation.

Alternate Concrete Design U. S. 21, West Virginia

(See Fig 18b above)

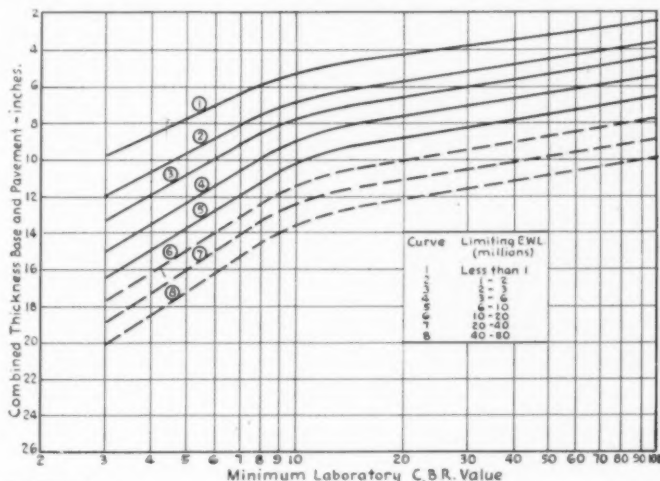
Longitudinal joints to be poured with rubber asphalt material, cost of which shall be included in bid price per square yard of pavement.

Transverse expansion joints $\frac{1}{2}$ in. wide to be spaced at 589 ft. intervals except as otherwise shown.

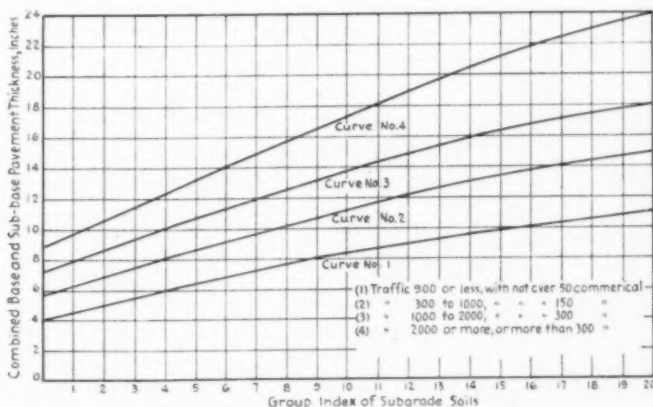
Contraction joints to be placed at 31 ft. intervals between expansion joints. Poured with rubber asphalt materials, as part of unit bid price.

614 Tons of Critical Materials Rounded Up

In response to a plea for scrap metal and other critical materials, Pennsylvania's Secretary of High-



★ Figure 19



★ Figure 20. Approximate total thickness requirements for flexible pavements. Based upon the Group Index of the subgrade soil and the traffic considerations. Ohio Department of Highways (Masheter and Marshall)

ways, Ray F. Smock, asked highway department district offices to round up such material. The response consisted of 614 tons of unserviceable

tires and tubes, mixed scrap iron and steel, oil and tar drums unfit for further use, aluminum, copper, tin, brass and junk storage batteries.



★ One of Pennsylvania's "V" type plows capable of bucking drifts 15 ft. high, clearing hard compacted snow as indicated by the footprints in the foreground

Pennsylvania Set With 7200-Unit Winter Fleet

By N. A. Staples

Chief Maintenance Engineer,
Pennsylvania Department of Highways,
Harrisburg

THROUGH use of a State-wide network of radio-telephone communications the Pennsylvania Department of Highways expects to reduce expenditures as well as increase efficiency of its snow operation during the coming winter.

Keeping the 41,000 mile State Highway System open for motorists at all times and under all circumstances has become a major part of the operations of the maintenance forces.

While the requirements differ from year to year, detailed preparations must be made each summer to meet any eventuality for in addition to the ever general weather pattern, Pennsylvania is bisected by a broad range of mountains that bring greatly varying local conditions.

Pennsylvania's 45,333 square miles of area averages 288 miles in length from the Delaware River to the Ohio border and 158 miles from the Mason-Dixon Line to the New York State border on the north.

The mountain ranges, generally

extending from the northeast to the southwest, usually mark the dividing line between heavy and light falls of snow. Frequently there is heavier snow and more icing north and west of the mountains, weather records reveal.

Uneven Snow Patterns

For example, the Pittsburgh region's Thanksgiving snow of 33 inches last

year decreased to two inches south and east of the mountains.

During the entire winter the northwestern counties averaged 171 inches of snow. Plows worked 83 days.

Below the mountains on the coastal plain the snowfall was much less.

Consequently there was a great difference in snow costs. The northwestern counties spent \$1,071,425 in contrast to the southeast expenditure of \$292,696.

Throughout the State snow removal and cindering cost \$9,245,690 for the winter of 1950-51, nearly double the preceding winter's expenditure.

The Department has experimented with a radio-telephone system in the principal snow counties, for several years. Success of the innovation has
(Continued on page 87)



★ Radio will greatly increase fleet efficiency in Pennsylvania this winter. Warren K. Kingsbury, maintenance superintendent for Dauphin County speaking to his office

This Drill Rig Gets "Away Up There"

A DRILLING platform mounted high up on a crane boom has helped an Arizona road contractor do one of the most difficult and troublesome parts of rock excavation, namely the job of scaling loose or semi-loose material in dressing rock-cut slopes.

As pictured here being used on a project on U. S. Highway 60, between Superior and Miami, Arizona, this machine was designed and built by Fisher Contracting Company of Phoenix, D. W. Fisher, president, taking a personal hand in it.

According to Mr. Fisher, "this device has no likeness to anything we have ever seen on other work. We designed it for a very specific purpose. Our problem on this project was that of widening a heavily traveled highway in solid rock cuts, without completely closing the road to traffic.

"Some of these cuts were 200 ft. deep in very rough terrain. Vertical drilling from the surface was not feasible, due to inaccessibility of the surface and the varying depth of the excavation. Consequently we decided to drill horizontal holes 3 in. in diameter, load them straight (without springing), and to work the face perpendicular to the center line of the new road. This brought about the design of the drill rig."

The outfit consists of a model 70 Link-Belt motor crane with a 70-ft. boom. A drill platform was mounted on the end of the boom to carry two 4-in. wagon drills mounted horizontally. The drill platform was held

★ Bulldozer bangs rocks loosened by blasing down onto roadbed



★ Link-Belt crane with 70-ft. boom supports this unique scaling and drilling platform, devised for Arizona road job.

level through a cable bridle arrangement which automatically controls the platform, regardless of the angle and height of the crane boom.

Air for the drills was furnished by a 500 cfm. Gardner-Denver com-

pressor mounted on a heavy truck for portability.

The drill could not reach the extremely high cuts and it was necessary to do some slope drilling from the top to obtain a satisfactory cut slope.

★ Another view of the special platform on the boom.

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★ Solid face of rock through which tunnel is being bored is shown in this general view

Due to the added weight of the crane boom, the machine is not easily moved from one location to another, according to Mr. Fisher. It is naturally necessary to operate on level ground. This requirement was not an extremely serious problem in the case of the U.S. Highway 60 project, however, as the old highway could be used to facilitate moving from one location to another.

In this operation, the scaling is done with crowbars to break loose rock from the mountains following

the blasting, as a preparation to further drilling. Upon several occasions rock slides damaged expensive road equipment in this work, a hazard which has largely been eliminated by the new device.

According to C. B. Browning, Construction Engineer of the Arizona State Highway Department, the platform as used on the U.S. 60 job was equipped with pipe railing to keep workers from "stepping off into space." The drill mounting consisted of a framework for carrying columns and bars for mounting one drill. Horizontal drilling was done with steel up to 20 ft. long.

Some concern was felt by the engineers over this special drill platform and rig, because the method could result in damaging the cut slopes, resulting in heavy over-break and unsightliness. Since the machine was an innovation and required considerable ingenuity to operate, the work was watched with special interest. Arizona highway men believe, after observing the device in action, that it has excellent possibilities. This is said despite the necessity of considerable caving in cuts above the boom height. By working from the top of the cut toward the bottom, the machine would allow the use of slope holes that outline the blasting and result in a more uniform cut section.

Details of Jumbo

In commenting on the project Del Fisher summed up the project by observing, "there isn't a shovel full of just plain dirt on the entire alignment. It is rock all the way."

The Superior-Miami highway is one of the most important and costly relocations in the southwestern U.S.* Very heavy excavation, a large steel arch bridge over Queen Creek canyon, and a 1,240 ft. tunnel east of the bridge, are features of this work, which

is the most difficult and "heavy" ever undertaken by the Arizona State Highway Department. Fisher's contract for the tunnel was expedited by a special large jumbo which drilled 18 powder blast holes in a single operation, this machine like the drill platform here described, being the product of the company's shop men at their Phoenix plant.

Since the tunnel has a center line height of 25 ft., the contractor's men took the upper 18 ft. the full 44 ft. wide at one cut, leaving a 7 ft. cut to be taken out in a second operation. The drill jumbo was equipped with ten 3½ in. Worthington drifters, one of which was mounted on a Joy hydro-jib to take care of the roof cut.

This trailer jumbo was mounted on a conventional truck-tractor. The rear wheels of the semi-trailer drill jumbo were hydraulically steered, so accurate spotting was no problem when the jumbo was backed into position.

Each round consisted of about 90 holes, ranging from 12 to 16 ft. deep.

The blasted material at the heading was excavated by a model 40 Lorain shovel. Muck was hauled with three diesel Koehring Dumpsters. Tunnel ventilation was handled by a 30,000 cfm. blower, driven by a HB 600 Cummins diesel engine. A 24 in. flexible vent tube was used to carry the air into the tunnel heading.

Progress averaged about 12 ft. per day on the tunnel by working one drill shift and one mucking shift. This allowed a full 6 hours after each blast for a cool-off period.

Rudd Elected Treasurer. Kenneth T. Rudd, heretofore assistant controller, has been elected treasurer of Link-Belt Speeder Corporation, with headquarters in Cedar Rapids, Ia. Harry E. Kellogg, who is vice-president and treasurer of Link-Belt Co. in Chicago, has previously served also as treasurer of Link-Belt Speeder Corporation. However, the growing volume of work made it desirable to have the treasurer located at headquarters.

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★ A shovel loads truck deep inside hard-rock tunnel U.S. 60 Arizona



★ Here is Fisher's jumbo, built for the U.S. 60 tunnel job



Bituminous

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Cover Scene

Troutdale-Dodson section of Columbia River Highway, Oregon, paved in 1951 with asphaltic concrete. See article in this issue on Oregon's asphaltic concrete experience.

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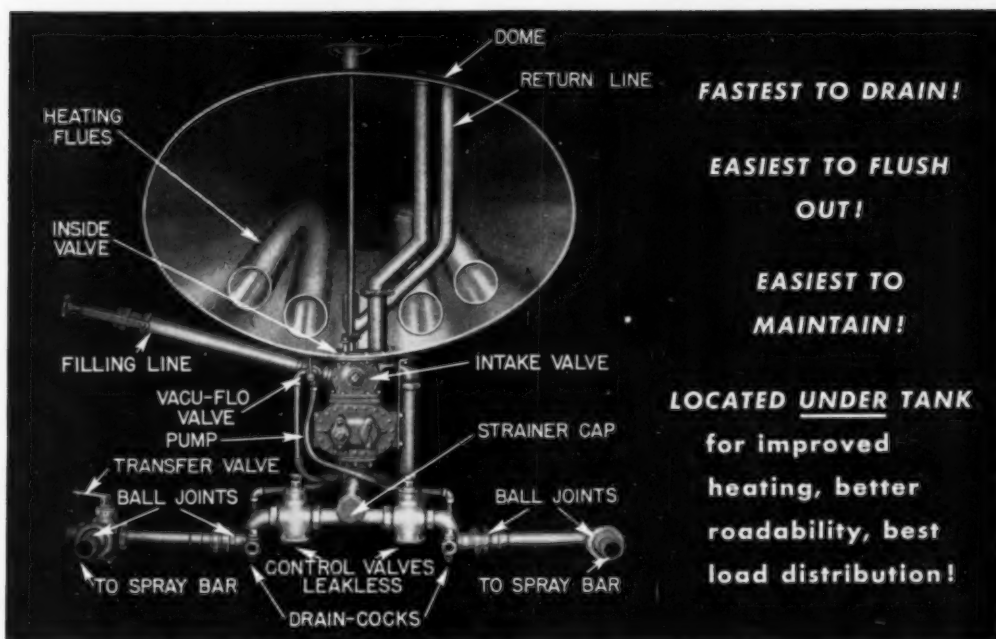


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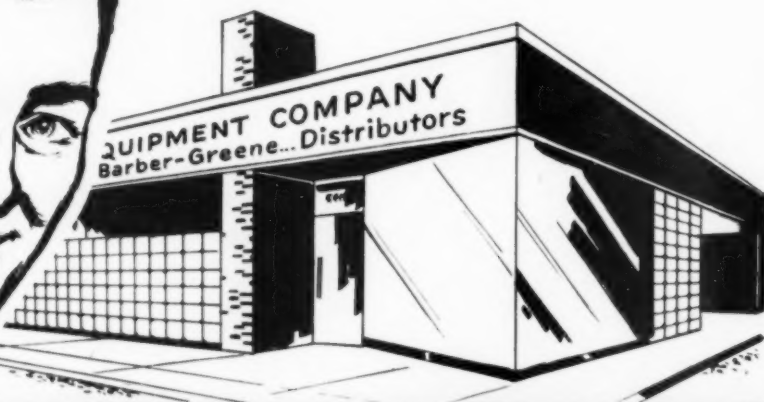
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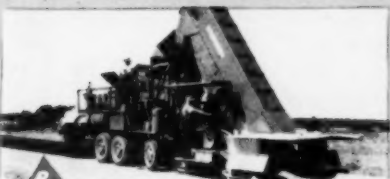
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freight costs. A Standard Asphalt Representative will help you take advantage of this short haul to better roads — to smooth, glare-free, safe roads.

Call on him too, for help in selecting the type of asphalt construction best suited to your needs and local conditions. For the services of a Standard Asphalt Representative, write:

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**STANDARD OIL
ASPHALT**

STANDARD OIL COMPANY



(Indiana)

A DOUBLE-BARRELLED MESSAGE FOR '52

CONTRACTORS:

MORE MILES OF
BETTER ROADS
AT LOWEST COST

HIGHWAY OFFICIALS:

MAKE YOUR
1952 BUDGET
STRETCH
FARTHER

with the
SEAMAN MIXER



The SEAMAN Self-Propelled TRAV-L-PLANT is equipped with pump, spray bar and tachometer assemblies for accurate application of bitumen or water. Volumetric flow meter is optional.

SOIL STABILIZATION METHODS

REVISED NO. 12

SEAMAN MOTORS, INC. 1 MILWAUKEE, WISCONSIN

If you're interested in highway, city street or airport construction you'll find this FREE book "Soil Stabilization Methods" invaluable. Just recently revised, it's very much up-to-the-minute. Please send for your FREE copy.

Cost records on SEAMAN-mixed road jobs show indisputable evidence that the SEAMAN-way is by far the most economical. That is a fact; figures prove it.

Now as to quality: SEAMAN-mixed bases are stronger. Binders are thoroughly, evenly and more scientifically mixed; coarse aggregates and fines more uniformly keyed and blended to give perfect control of voids. Core samples prove it. And, that means a higher resistance to the pounding of traffic and deterioration from weather.

Lowest cost, longer life and higher load-bearing values. Those facts are true in any SEAMAN stabilization whether the mixing process involves bituminous binders, soil-cement, chlorides, macadam or gravel.

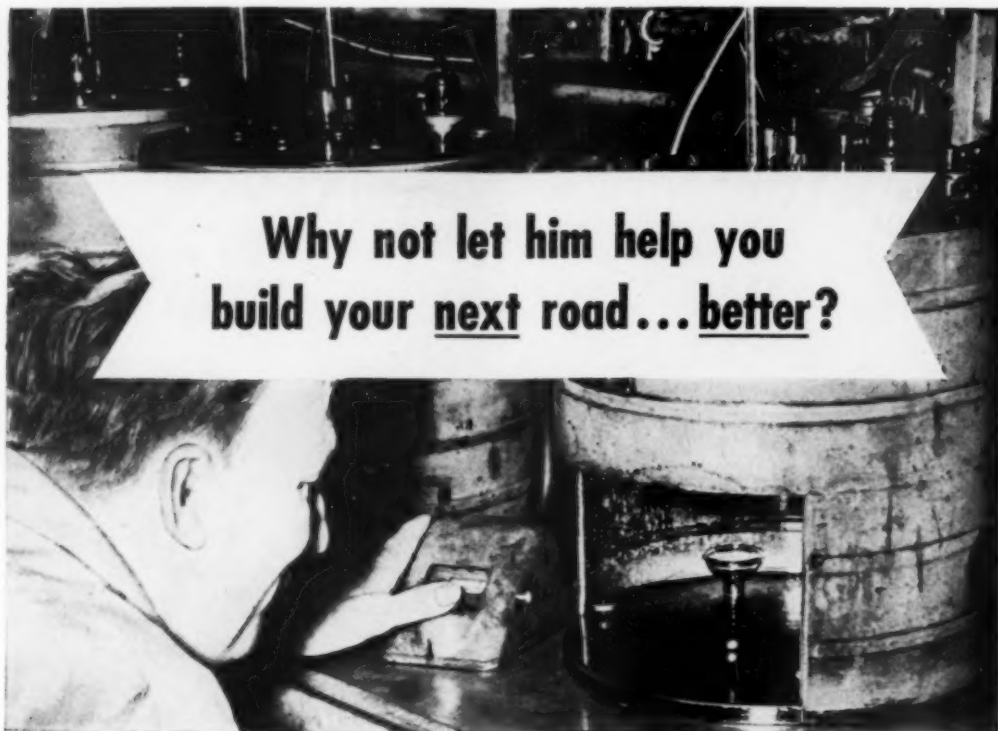
And that is why you as a highway official can make your '52 budget go many miles farther for better road construction. And you, Mr. Contractor, can speed up your 1952 schedules and sharply cut your costs.

So in 1952, do ALL your mixing with a SEAMAN.

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**Why not let him help you
build your next road... better?**

**Get the answers that assure better roads from Ohio Oil's
modern laboratory... without cost or obligation**

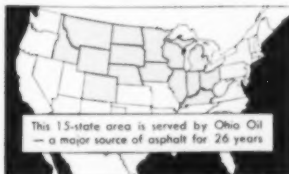
It takes a lot of answers to build a better road. Answers to such questions as: How satisfactory a mix will my local aggregate make? How thick should the base and wearing course be? How will the subgrade and paving stand up to winter rains and spring thaws?

These questions—and plenty more like them—can be answered easily and conclusively by Ohio Oil's skilled engineering staff... working in one of the most completely equipped laboratories in the industry. Why not write, wire or phone for the answers to *your* questions, today?

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FINDLAY, OHIO • LOVELL, WYOMING • Producers of Petroleum since 1887



"Building" roads in the laboratory...
assures satisfactory performance on the job





★ The gauge developed in Illinois for checking on rise of slabs during undersealing.

NOTES ON ILLINOIS PRACTICE IN

Asphaltic Resurfacing

Noting some refinements developed in completing 1,500 miles of bituminous concrete resurface work on the state system since 1942

By F. N. Barker

Chief Highway Engineer,
Illinois Division of Highways

SINCE 1942 the Illinois Division of Highways has rehabilitated more than 1500 miles of old rigid pavement (portland cement concrete and brick) by resurfacing with bituminous concrete. The old pavement is usually widened prior to resurfacing. Our standard design for this type of construction provides for a binder course and a surface course, each $1\frac{1}{2}$ inches in thickness.

A large percentage of the bituminous resurfacing is placed on "pumping" pavements, which require undersealing. Fewer cracks develop in resurfaced pavements which have been undersealed, because uniform support is provided for the old slab. Petroleum Asphalt PAF-3 is forced into holes drilled in the pavement near pumping joints (and other locations designated by the Engineer) until the cavities be-

neath the pavement are completely filled. The problem here is to detect the instant when the slab begins to rise, since it is a waste of asphalt to lift the slab after the cavity beneath it has been filled.

A simple gauge device for detecting slab movement has been designed by one of our resident engineers. The gauge has three fixed bearing points

which are placed on the slab which is to be pumped. The long arm, which has an adjustable bearing point, extends out over the pavement outside of the slab being pumped. The adjustable pin is set to touch the pavement before pumping operations start. Movement is indicated when the adjustable pin rises off of the pavement. The use of such a gauge permits accurate control of the asphalt, particularly on pavements that have been widened.

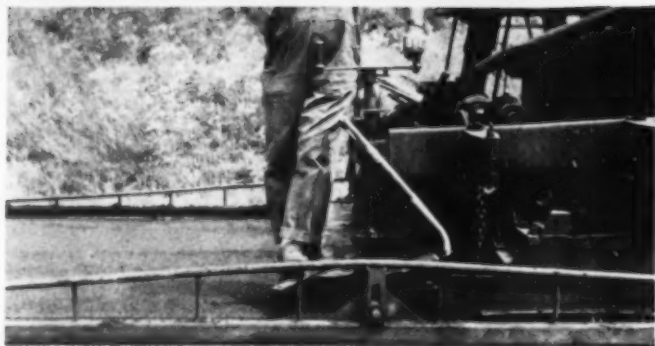
Control of Leveling

Old pavement which is resurfaced

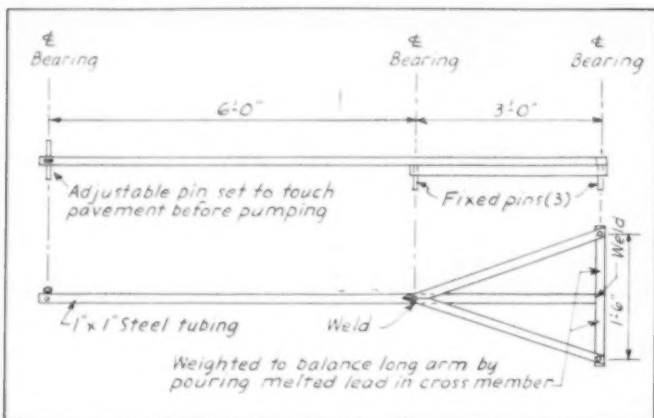


★ Close-up of gauge, which can be built quickly with simple materials. See also sketch of details.

BITUMINOUS ROADS AND STREETS



★ 25-ft. "ski" attachments devised as an aid in placing leveling binder. Seen in use on Illinois state bond route 1 resurface job; Trinidad Asphalt Mfg. Co., contractor



★ Details of gauge for checking the rise of slabs during undersealing.

is frequently very rough, due to broken slabs and settlement. In such cases, it is advisable to place a leveling binder on the old pavement prior to laying the binder course. This results in three-course construction, since the leveling binder is followed by the usual binder course and surface course. The leveling binder evens out irregularities and insures a smooth-riding surface for fast-moving traffic. All depressions of one inch or more in the surface of the existing pavement are filled with leveling binder either by hand methods or machine methods.

As an aid in placing leveling binder a "ski" attachment for a bituminous finishing machine has been developed for use when the binder is placed by machine methods. The attachment was designed by one of our resident engineers and has produced very satisfactory results. As shown in the pictures, the device is essentially two steel runners, attached at the center to the screed of the finishing machine. The

runners are 25 feet long and are made up by welding two channel sections together. In operation, the ski attachment levels out waves in the existing pavement by raising the screed at low spots. The amount of bituminous mix-

ture (pounds per square yard) is not materially increased when leveling binder is placed by machine, since the quantity of binder course is reduced slightly to allow for the thickness of the leveling course.

Rigid Plant Requirements

The asphalt plants which produce bituminous concrete mixtures must meet rather rigid requirements. Each plant is surveyed after it has been moved and set up in a new location. Deficiencies which would affect the quality of the bituminous mixtures must be corrected before the plant is permitted to operate.

Bituminous concrete surface course mixtures are designed by the Marshall method. The stone, sand, mineral filler, and asphalt cement which will be used on a project are combined in the laboratory in different proportions and the Marshall tests are made on these combinations. The test results are sent to the project engineer with recommendations for proportioning. After work starts, samples are taken at the asphalt plant and sent to the laboratory for Marshall tests.

Improving Mixtures

During the past few years, the Division of Highways has been running a series of tests for the purpose of improving the design of bituminous concrete mixtures. Samples are taken from bituminous concrete pavements which have been in service for a number of years and Marshall stability and flow tests are made. The effect of aging of asphalt cement in bituminous concrete is also being investigated.

Inspectors and field engineers on bituminous construction are trained and supervised by the District Engineer of Construction and District Engineer of Materials. Each bituminous project is inspected periodically by a supervising engineer from Springfield, in order to insure uniform con-



★ Closer view of the leveling "skis" used on Illinois resurfacing.

Light Road-Mix Retread—Montana's Solution for Maintenance of Bituminous Surfaces

On Montana state highway maintenance, where a bituminous surface cannot be reconstructed, an expedient has reduced maintenance costs and improved the riding qualities at a cost of 12.5 cents per square yard. A surface slightly greater in average thickness than a seal coat results from the process here reviewed.

THE problem of maintaining low cost bituminous surfaced highways in Montana is presently of major importance, according to maintenance engineers of that state, and will continue as such for an indeterminate time. Many years ago the public demanded bituminous surfaced highways. The low cost penetration type bituminous surface or light road mix bituminous mat of a correspondingly low cost was the result. At the time of this construction, and for a number of years thereafter, traffic volume was not great. Freight transport was also in the early stages of development.

Suddenly, or so it seemed, bituminous surfaced highways began to disintegrate, in spite of continuous spot or skin patching with asphalt and mineral aggregate. Continuous repair of this type tended to create a rough, irregular riding surface. Accordingly, the Montana state highway department has adopted a special procedure for method of repairing and improving bituminous surfaces. This method was originally known as "Tight Blading," but has since been called "Light Road Mix Retread," "Honing Operations," and by other names. Basically the procedure is simple, as described by a maintenance engineer in the highway commission:

How it is Done

(a) The section planned for treatment is first patched with premixed

struction methods and standards.

Bituminous construction on flexible bases is used for secondary routes or primary routes with light commercial traffic. Flexible bases in Illinois are usually built with gravel or crushed stone, although soil-cement bases have been constructed on a few projects. The design tables of the Highway Research Board are used to determine the required thickness of flexible bases. The design thickness thus obtained is sometimes checked by either the North Dakota cone bearing test (if the soil is fine) or the C.B.R. test (if the soil is granular).

bituminous treated aggregate. This operation is designed to raise subsided sections, correct irregularities, etc.

(b) Untreated mineral aggregate, preferably 100% passing the $\frac{1}{2}$ -in. screen, is then delivered to the roadway and spread in amounts ranging from 250 to 400 cu. yd. per mile, depending on original mat surface condition. This aggregate is neatly windrowed on the edge of the oil mat. The roadway is then swept clean of all dust or other foreign matter.

(c) Following the windrowing of aggregate and roadway preparation, the crew is ready to begin actual oiling operations. An approved pressure distributor is utilized in applying asphalt to the roadway surface, one-half the total width on the side adjacent to the windrowed aggregate. The rate of application is varied according to bituminous surface condition; thus, if the oil mat is cracked and visibly porous, the rate is increased. Generally the rate of application varies from 18 gal. to 28 gal. per cu. yd.

Immediately following the application of asphalt to one-half the roadway, motor patrols move the windrowed aggregate across the freshly oiled section. Sufficient aggregate is allowed to remain on the oiled section to blot any excess bitumen. The operation is then repeated, with the distributor applying asphalt to the other half of the roadway, and the motor patrols following, blading the aggregate on across the roadway. It is always necessary and desirable to broom the roadway shoulder on which the aggregate was windrowed originally, in order to incorporate all dry aggregate into the treatment. Brooming follows the first pass made by motor patrols. It is usually necessary to then make a narrow application of asphalt on the shoulder whereon the windrowed aggregate originally rested.

Continuous Mixing

(d) Following the full width application of asphalt to the roadway, all motor patrols begin a continuous mixing operation. As much pressure

is applied to the cutting edges as the oil mat will withstand. This serves to cut off all high spots and corrugations, as well as to recover any excess bitumen from the surface under treatment. As blading and processing continue, it will be necessary in most cases to apply additional bitumen to the aggregate itself. This should be done as quickly as possible in order to expedite the entire operation. Immediately when all aggregate is sufficiently coated with bitumen to produce a finished mix, disposal of excess aggregate is in order. Ordinarily, a laydown operation is advisable, although the quantity of aggregate is not so great as to require detailed finishing. It has been the experience that excess material laid from the quarter point to the mat edge produces the best results. This will vary according to existing conditions, however. During the laydown and finishing operation the engineers have found it desirable to employ a 6-ton tandem roller. It is also the practice to roll a completed section on the day following the lay-down operation. Better results are obtained if this entire operation is completed the same day it is started, although conditions may make it necessary to carry the operation into a second day.

Good results have been attained with both MC and SC asphalt. The cost per mile will vary from \$1500 to \$2000 per mile. Maintenance costs on sections treated in this manner have reportedly decreased as much as 80%. Period of service depends somewhat on foundation material, but the engineers expect, and have experienced, from three to five years of minimum maintenance on sections treated thusly.

Meetings Ahead

HIGHWAY RESEARCH BOARD—Annual Meeting, Washington, D.C.; January 15-18.

AMERICAN ROAD BUILDERS ASSOCIATION—50th Anniversary Convention, Rice Hotel, Houston, Texas; January 21-24.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS—Annual Meeting, Netherland Plaza Hotel, Cincinnati, Ohio; Jan. 28-30.

ASSOCIATED EQUIPMENT DISTRIBUTORS—Annual Convention, Stevens Hotel, Chicago; Jan. 27-31.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC.—Annual Convention, Statler Hotel, Detroit, Mich.; February 25-28.



★ Specially fitted distributor helps California road crew work from two nozzles at a time in asphalt undersealing.



★ Scraper being used on rock-clearing operations on Ohio U.S. 52

Special Equipment Aids Subsealing

California Division of Highways Maintenance men are using new truck-mounted heating and pumping units, built in their own shops, on asphalt subsealing of old rigid pavements. The units have a fully insulated tank with a capacity of 1,600 gallons.

Heat is furnished by three pressure type burners which use about six gallons of diesel fuel per hour. 1,600 gal. of 10-25 penetration asphalt can be raised from 60°F to 450°F in about 2.5 hours.

A 250 gal/min., high-pressure pump is used with the unit. Working pressure is 40-50 psi., but the high-pressure equipment insures against breakage due to sudden stoppages. The pump supplies material through two hose lines, permitting sealing through two holes at the same time. Return hoses permit circulating the material through the nozzle heads when not sealing.

Nozzles are equipped with a valve to permit changing from sealing to circulating of material, and a disc head on which a workman stands to force the tapered nozzle tightly into the 2-in. hole drilled in the pavement.

Using these units, State maintenance forces have been placing from 6 to 20 gallons of material into each of 300 to 400 holes per day. The State has spent about \$1,000,000 on asphalt subsealing work in the past five years.

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Hopkins Combination Oil-Gas Dryer Unit

● The Hopkins Volcanic Dryer Unit gives you greater tonnage with less fuel, less cost. It's rugged, reliable, economical, and efficient—a COMPLETE "package unit" combustion system designed especially for asphalt plants.

Hopkins low pressure air equipment is adaptable to any dryer size or design, and so complete it can be installed in as little as 6 hours. Investigate these low-cost burning systems today. A letter or phone call puts our specialized experience to work for you.

Hopkins Volcanic Specialties, Inc.
Alliance, Ohio

Cliff Cut Back 30 Ft. to Keep Slides Off Highway

Here pictured is a Super C Trencher cleaning pavement of shot rock on U. S. Route 52 at East Portsmouth, Ohio. This job is being done by the Red Eagle Corporation of Columbus for the Ohio department of highways. Purpose of the job is to cut a shale and sandstone cliff back about 30 ft. as a measure to prevent rock slides from blocking the highway.

Thos. H. MacDonald Is Reappointed

Thomas H. MacDonald, Commissioner of Public Roads, who reached statutory retirement age in July has been reappointed by Secretary Charles Sawyer of the Department of Commerce.



1918 Perfection
Body and Hoist

Progress is Continuous



Photo shows a modern clover leaf intersection in New York State. Photo by Harold M. Lambert.

"Progress" is continually making problems that yesterday's answers will not solve. Today's increased traffic requires a different approach than the simple right or left turn of yesterday.

Today's and tomorrow's haulage problems also demand truck bodies and hoists of much faster operating speed, more ruggedness and larger capacity.

Compare the two units pictured on this page — they contrast PERFECTION'S 33 years of continuously improved design. Thirty-three years ago PERFECTION'S good reputation was established on the outstanding service of those "little old" bodies and mechanical hoists.

PERFECTION TRUCK BODIES and HYDRAULIC HOISTS

maintain their leadership today by their unexcelled performance, their up-to-the minute engineering and sturdy construction. Write for literature.



Photo shows a modern PERFECTION No. 334 Heavy-Duty Dump Body of 18 cu. yds. capacity (with sideboards) mounted with No. 1034 Iso-Draulic ROLL-A-LIFT.

PERFECTION
STAKE and DUMP BODIES
HYDRAULIC HOISTS



FOR ANY TRUCK
STANDARD or SPECIAL UNITS
IN ALL SIZES - FOR ANY USE

Engineered, Manufactured, and Guaranteed by
THE PERFECTION STEEL BODY COMPANY Galion, Ohio, U. S. A.



★ Asphalt plant of J. C. Compton, McMinnville, Oregon

What the States are Doing to Develop

Better Bituminous Roads

1—First of a series of state-by-state "highlight summaries" on bituminous and flexible base construction advancement

Oregon

By R. H. Baldeck

State Highway Engineer of Oregon, Salem.

THE first asphaltic concrete pavements of Oregon carried a high asphaltic content and produced a smooth asphalt-coated, watertight surface. These pavements had little skid resistance and, when wet, were slick and extremely hazardous. One of the first acts of the writer upon becoming Maintenance Engineer of Oregon in 1925 was to nonskid these pavements. In many cases, prior to placing a nonskid surface made of asphalt and stone by the penetration method, the surfaces were planned to remove the excess asphalt. In some cases where this was not done, the excess asphalt soon blotted up the stone in the nonskid course and the surface became slick again.

Some of these early pavements were only two inches thick and placed on bases inadequate for present-day traffic. Practically all of these pavements are still functioning, although many have been relegated to secondary roads by necessary alignment correc-

tions involving the relocation of sections of the road. Nearly all of them have been planned to remove excess asphalt, and all have been given a nonskid coating to eliminate a slick surface. Some have required exces-

sive maintenance, but in general they have proved satisfactory.

Stood Traffic Well

For the most part the old type pavements, which have withstood heavy traffic these many years and are still in good condition, are 5 inches thick, placed on 8-inch compacted stone bases. The present practice is to use pavements 3½ inches thick on much



★ Heavy traffic including logging and lumber trucks have complicated the road design problem in Oregon



**APPLY
TARMAC**

for Greater **ADHESION**
DURABILITY
PENETRATION
SKID-RESISTANCE
WETTING CAPACITY
STRIPPING-RESISTANCE

WHEN you're ready to resurface old roads or build new ones, take advantage of Tarmac's many valuable properties—properties that result in faster job progress . . . in lower labor costs . . . in durable, long-wearing, smooth-riding road surfaces.

Consider, for example, Tarmac's ability to coat the aggregate rapidly and thoroughly, thus reducing mixing time. Plus its ability to penetrate *right on through* dust or moisture, so

that there's no need for highway crews to remain idle while waiting for the "right" weather. Important, too, is the way Tarmac resists the stripping action of water, without the use and the extra cost of additives.

Tarmac Representatives are ready to discuss *your* highway construction and maintenance problems — without charge or obligation. Why not write us, and learn *all* the advantages of using Tarmac?



KOPPERS COMPANY, INC., TAR PRODUCTS DIVISION, DEPT. 1132T, PITTSBURGH 19, PA.

Tarmac **MAKES BETTER ROADS**

The MAJORITY of Your Heavy Hauling Jobs can be handled PROFITABLY with... the POPULAR



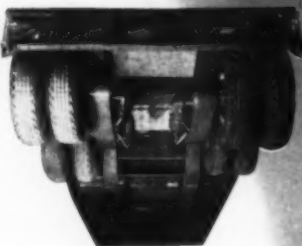
➔ ROGERS Type "T"

**LARGE CAPACITY IN AN 8 FT. DECK
WIDTH—LEGAL IN ALL STATES. 8
TIRES ON 2 ROCKING STUB AXLES
WITH LEVEL OR DROP DECK IN 15,
20, 25, 30 and 35 TON CAPACITIES**

By reason of its versatile adapt-
ability to all kinds of heavy
hauling jobs, the Rogers Type
"T" has steadily increased in
popularity.

It's a "natural" for small and
large contractors and haulers.
If you are considering the pur-
chase of one or more trailers,
by all means investigate the
Type "T".

It packs powerful advantages
in a multi-purpose single unit.
Write for full details and cat-
alog.

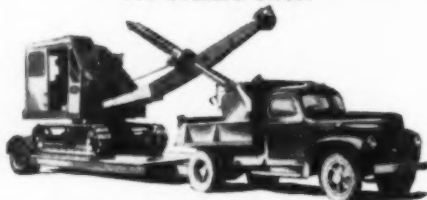


A worms-eye view of the sturdy
rear end and frame construction
of the famous "T".

The rear end design of the
Type "T" has proved so ef-
ficient it has been adopted
as standard construction in
Rogers Power-Lift Detachable
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EXPERIENCE builds 'em		PERFORMANCE sells 'em
ROGERS BROS. CORP.		
ALBION, PENNA.		

110 Orchard Street



Also of timely interest in this ROGERS Tag-A-Long trailer which makes
a dump truck serve as a tractor and effects sizeable savings for contractors.

heavier foundations.

Many changes in design of asphal-
tic concrete pavements have been
made. Due to the experience with
slick pavements caused by heavy as-
phaltic seal coat placed with a squee-
gee cart on top of the newly laid as-
phaltic concrete surface, it was the
practice for several years to lay pave-
ment without any seal coat whatso-
ever. Inasmuch as it is very difficult
to get the gradation of the aggregate
and the asphaltic content just right all
the time, experience indicated that in
certain cases too much asphalt was
used, and under heat and heavy traffic
the roads became slick. In other cases
deficiency in asphalt caused spalling
of the surface. Generally these roads
completed in the early spring tended
to flush up a little in the summer,
whereas those roads finished in the
late fall would spall in the winter. In
order to minimize these two evils, the
present practice is to hold down the
asphaltic content a little below the
"required" amount and to place a seal
coat of about a quarter gallon of emul-
sion covered by stone chips ranging
from $\frac{1}{4}$ -in. to 10 mesh in size.

Sometimes those roads that are
built right in the middle of the hot
summer tighten up sufficiently to give
an impervious surface, while at the
same time there is no manifestation
of a slippery condition. In these cases
the seal coat is left off. The pavements
finished in the early spring and the
late fall are always sealed. The $\frac{1}{4}$ -in.
— 10 mesh material gives an excellent
uniform nonskid surface and is prefer-
able to the type of surface obtained
even under the best conditions without
its use.

Observations of pavement life indi-
cate that as time goes on the asphalt
tends to harden through oxidation, but
in the main those pavements which be-
come brittle are those which are built
with hard asphalts combined with a
high mixing temperature. Formerly we
used 50-60 penetration asphalts. We
now specify asphalt of 86-100 pen-
etration.

Mixing time of the shortest dura-
tion compatible with a product of uni-
form texture is recommended as a
factor toward long asphaltic pavement
life. Aggregates are not heated above
325° F., in comparison with the previ-
ous maximum of 350° F. Heating of
the asphaltic cement above 375° F. is
a cause for rejection. The temperature
of mixes laid on the road is between
250° and 300° F.

Even though longevity is important,
the use of an excess of asphaltic ce-
ment, which will of course prolong its
life, must be avoided. Where an ex-
cess exists it is in direct conflict with
stability and bearing value and tends

to eliminate the nonskid characteristics of the pavement surfaces. By tri-axial testing of molded specimens, it is possible to evaluate the balance required between stability and cohesion.

Recent Specification Changes

Recent changes in our specifications for hot plant mix asphaltic pavement construction are as follows:

1. When the mix is placed on new rock bases, we find it advantageous and economical to precede the plant-mix with a penetration-type binder course treatment of RC-3 or MC-2 asphalt at 0.25 to 0.50 gal. per sq. yd., covered with $\frac{3}{4}$ in.-0 in. crushed cover material at 0.009 to 0.012 cu. yd. per sq. yd. We find that this treatment levels and stabilizes the base, provides firm surface for plant-mix, seals off moisture from below, and saves plant-mix material otherwise used in filling ruts and irregularities of non-treated bases.

2. We have modified our $\frac{3}{4}$ in.- $\frac{1}{4}$ in. coarse aggregate requirements to permit use of partially fractured gravel, in lieu of all crushed, permitting 40% by weight to be uncrushed. This represents a saving of from 25 cents to 50 cents per ton of mix without appreciable loss of stability.

3. Use of volumetric proportioning and continuous mixing plants is permitted, provided that they will deliver a specified product.

4. We are now exercising closer temperature controls, as noted.

5. All plant-mix asphaltic concrete pavements in this state are two-course construction, each course using the same mix (a $\frac{3}{4}$ -in. maximum size aggregate, close-graded, dense type); all are sealed with emulsified asphalt at 0.15 to 0.25 gal. per sq. yd. covered with $\frac{1}{4}$ in.— $\frac{1}{8}$ in. aggregate at 0.003 to 0.007 cu. yd. per sq. yd., broomed and rolled.

6. On projects involving 6,000 tons or more of mix, we require the proportioning of the aggregates to close conformance with mix requirements prior to heating; on projects involving less than 2,000 tons we permit use of drum-type mixers, small continuous-type mixers, or other methods below normal standard specification requirements to encourage small bidders and to hold down costs.

Gradation Problems

The obtaining of uniform grading of aggregates has given us some trouble lately and has occasioned some slowdown in plant output. Our contractors have not been required to stock-pile aggregates at the plant site in separated sizes. In places where the materials are separated into different sizes, it is possible by careful

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BUILDS IT BETTER

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- ENDURANCE IN THE FIELD
- LONG-RUN ECONOMY

FOR ROAD BUILDERS—who demand longer-lasting and trouble-free equipment there is no better buy than Heltzel steel forms, Heltzel portable bulk cement plants and Heltzel portable aggregate plants. On every concrete highway and airport project you will find men who know the dollars and cents value of Heltzel equipment.

PORTABLE BATCHING PLANTS—Portable aggregate plants in capacities of 30, 45, 52, 72, 85 and 100 tons. Portable bulk cement plants in capacities of 100, 200, 300 and 400 barrels—and 9 sizes of portable recirculators to assure reserve storage to meet every requirement. Standard batchers will service 34E pavers—or dual batchers for the fastest batch truck operation obtainable.

HIGHWAY-AIRPORT FORMS—Standard forms for highway and airport construction are all-welded steel—featuring wide tread, upturned base flange and 5 rigid supports per form. Heltzel's exclusive dual duty forms are demanded by contractors who want one set of forms to pour two slab thicknesses from 6" to 24."

Write for 9-piece kit of contractors' literature

HELTZEL
STEEL FORM & IRON CO.
WARREN, OHIO



★ Paving urban project, entering Tillamook City, Oregon

volumetric proportioning to almost eliminate an excess amount of any size in the hot bins, and the Oregon State Highway Department is now giving thought to specifying the placement of the material of different sizes in separate piles so as to insure more uniform control, which should increase production and reduce cost. During 1951 the State program included placing 600,000 tons of asphaltic concrete under contract.

Our maintenance method of repairing asphaltic concrete pavements is based upon the use of special crews operating small portable asphaltic concrete plants of from 100 to 200 tons daily capacity. The State has ten such plants which place about 155,000 tons a year at an average cost of \$8.40 a ton in place. We have found that these plants are effective in stabilizing weak spots in the pavement and permit our keeping the pavement smooth at all times. The spreading of the patching material is done by means of a motor grader. Emulsion is used to paint the old surface and to seal the new patches.

Minnesota

From O. L. Kipp, Chief Engineer and Assistant Commissioner, Minnesota Department of Highways, St. Paul.

A development is the experimental rubber asphalt paving now under contract on University Avenue between Rice Street and Dale Street in St. Paul. On this project some sections will be constructed using an asphaltic concrete mixture in which the asphalt cement for the leveling course will contain 10% by weight of rubber compound while 15% will be used for the wearing course. The rubber compound is to be a mixture of rubber, natural and synthetic resins which will blend with asphaltic materials to form a homogeneous product. It is required that the rubber compound contain not

less than 15% of rubber hydrocarbon. This work will be completed before the end of the 1951 construction season.

Vermont

From H. E. Sargent, Chief Engineer, Vermont Department of Highways, Montpelier.

This department covered approximately 30 miles of concrete road with bituminous concrete in 1950, the thickness varying from 1½ to 2½ in.

Pavement of 1½ or 2 in. thickness is laid in one course the width of the concrete pavement; 2½ in. pavement, in two courses. In nearly all municipal work a 2½ in. depth is used with a leveling course where necessary. Shoulders are paved wherever possible 3 ft. wide with bituminous premixed material, using an MC-3 for binder. In some cases we have used an anti-stripping additive (Nostrip) with the asphalt, particularly in cool weather. In other instances crusher-run aggregate is primed with MC-1 and allowed to stand for two or three

weeks, then mixed with an MC-3. Occasionally this state uses a blended tar with a shoulder mix, the blend being 50% T-5 and 50% T-9.

Where the road surface has been widened with bituminous concrete, a premixed material is placed to a depth of 3 in. outside of the concrete and finished ¼ to ½ in. higher than the adjacent concrete. The reason for this being left higher is to allow for rolling and to get proper compaction next to the slab. It has been found where this has been done there has been very little cracking in the adjacent pavement.

All concrete surface is primed with quick breaking emulsion just prior to applying the bituminous concrete. The center line joint is primed with emulsion just prior to paving the adjacent strip. 85 to 100 penetration asphalt is used in the mix except in the late fall work, when use of 100 to 120 penetration asphalt is considered.

Several highway districts in Vermont have been using combinations of RC and MC cut back asphalts to obtain a minimum of retained asphalt in mixes that are workable in cool weather and with aggregates containing small amounts of fines. 50% RC3 and 50% MC3 is the combination most often used. In cases where the weather is very cool or the amount of fines is large, the MC is increased and the RC decreased. When the amount of MC is increased due to cool weather, care must be taken to do sufficient mixing to allow the kerosene to evaporate.

"Kotal" and lime have been added to patch material with good results, using a Barber-Greene mixing plant. Several deposits of gravel in the state are hydrophilic. During previous years patch produced from this material has

(Continued on page 74)



★ Darker pavement in foreground has 6½±% asphalt content; lighter pavement, 5½±%.



1. Cutback asphalt spread thinly by brooming.



2. Leveling material roughly spread by shovel.

Spot Leveling Blade Helps Make Smoother Patch

By R. N. Jennings

District Maintenance Engineer
Texas Highway Department, San Angelo

IT has been found that certain conditions of roughness in pavement can be corrected more cheaply by spot leveling with hand methods than by utilizing machine methods. The unit cost of material placed runs considerably higher when placed by hand due to higher labor cost but a small amount of material can accomplish very good results.

A hand machine has been developed by Jim Butler, Highway Department Foreman at Garden City, Texas, to lower the cost of the preliminary leveling of the asphaltic material used. This machine consists of a six-foot grader blade with two small dolly wheels and two shaft handles. The wheels and shafts are made with flexible joints to permit easy maneuverability. Elevation of blade is adjusted by raising or lowering handles. The blade is used only to spread the material as final leveling is done with a standard straight edge.

(As reported in the Texas Highway Department's Construction and Maintenance Bulletin No. 7.)

Literature Received

"Landslides." Bibliography No. 10, Highway Research Board. Compiled by Jessie M. Tompkins and Severine H. Britt, U.S. Department of the Interior Geological Survey, in 1951. This is a selected annotated bibliography of 54 pages including 291 separate references, which should make the publication invaluable to highway engineers and others concerned with land-

slides. The authors acknowledge the contribution of abstracts and suggestions by E. B. Eckel, D. J. Varnes, and H. Varnes. Sponsored by the Committee on Landslide Investigations of the Highway Research Board. For a copy

address the Board at 2101 Constitution Avenue, Washington, D.C.

Research Proceedings

The 1950 Proceedings of the Highway Research Board has been issued as a 531 page volume, price \$7.50. Send request for copy to the Board at 2101 Constitution Avenue, Washington, D. C. This volume contains the bulk of the technical papers, percent and committee reports presented at the annual meeting held in Washington, January 9-12, 1951.



3. Machine spreads and levels out to small windrows.



4. Machine raised to permit feather edging.

5. Final leveling with straight edge.



Notes on Equipment and Materials For ENGINEERS AND CONTRACTORS

Steam Cost Calculator

A new and modernized "slide rule" type calculator designed to provide a ready means of computing steam costs has been made available by the Cleaver-Brooks Co., manufacturer of steam boilers and other equipment for the generation and utilization of heat. The calculator, in handy pocket size, is available

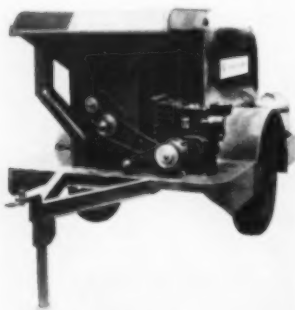


Steam Cost Calculator

without cost to engineers, plant executives, and those who will find it useful in their work. The calculator enables the user to compute the comparative steam costs per 1000 lb. using coal, oil, or gas—and based on fuel costs of price per ton, price per gallon, and price per cubic foot. Cleaver-Brooks Co., 326 East Keefe Ave., Milwaukee 12, Wis.

Patching Unit

A new mobile patching unit, called the Moto-Patcher, announced by Hetherington & Berner, Inc., is designed for use behind a truck, and consists of a feed hopper, mixing conveyor, bitumen tank and tank heater, using either bottled gas or kerosene. It has a 400 gal. bitumen tank. The mixer running through the bitumen tank gives a drying effect to the aggregate. If desirable, bitumen may be circulated when the machine is not mixing. Front and rear connections are provided for hand spraying. The mixed material is deposited on a pan of convenient height for shoveling, or it can be dropped directly onto the road surface. The Moto-



Moto Patcher

Patcher delivers up to 10 tons of freshly mixed material per hour. Aggregate may either be shoveled into the hopper, or fed into the hopper by a small elevator, which is optional equipment. Hetherington & Berner, Inc., 701-45 Kentucky Ave., Indianapolis 7, Ind.

Utility Spray Tank

New and improved design of its four-wheeled trailer type Model 101 utility spray tank for road construction and maintenance work, has been announced by Littleford Bros., Inc. This highly portable utility unit is now constructed with a self-supporting tank, the elimination of a heavy frame. The new design is simple



Littleford Model 101 Utility Spray Tank

and it eliminates the dual tires both front and rear. The four-wheeled frameless trailer 101 is made in 800 and 1000 gal. capacity. It has a spray bar for small application jobs, hand spray attachment for general patch work, and a pouring pot outlet for crack filling and patch work on highways, streets, runways and parking areas. Littleford Bros., Inc., 453 East Pearl St., Cincinnati 2, O.

Triple Roll Crusher

A 54 in. x 24 in. triple roll crusher has been added to the line of Pioneer Engineering Works. This new crusher is



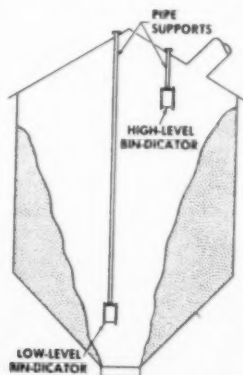
54 in. x 24 in. Triple Roll Crusher

big brother to the 40 in. x 22 in. and 30 in. x 18 in. triple roll crushers which have been available for some time. The new crusher has been designed for reduc-

tion crushing behind a 3042, or larger, jaw crusher, and is available either for stationary or portable installations. Because of its high stage of reduction (two stages in one crusher) the 54 in. x 24 in. triple roll is stated to permit greater opening of the jaw crusher setting, thereby increasing plant output. Stage of reduction varies from 6½ in. to 2 in. when producing minimum sizes of products from 4 in. to ¼ in. minus, respectively. This means that when producing 4 in. minus product, pieces up to 9 in. x 9 in. can be fed the crusher. When producing ¼ in. minus material, pieces up to 2½ in. x 2½ in. can be fed. Nominal production is stated to vary from approximately 35 tons an hour of ¼ in. minus, to 500 tons an hour of 4 in. minus, based on material weighing 2700 lbs. per cubic yard. Pioneer Engineering Works, 1515 Central Ave., Minneapolis 13, Minn.

Bin-Level Indicator

A new, special model bin-level indicator, announced by The Bin-Dicator Co., is claimed to solve the problem of securing dependable level indication in large bins. The new unit, known as Model CS Bin-Dicator, is designed for suspended installation from above and can therefore be located anywhere in the bin where there will be a free flow of material to and away from the diaphragm. This flexibility as to location permits the



Installation View of Model CS Bin-Dicator

successful application of the unit in bins containing materials which tend to build up on the walls of the bin and to flow down through the central area only. The unit is designed to be drilled and tapped to take any size pipe up to 2 in. The support pipe also accommodates electrical wiring, making conduit unnecessary. Because of the manner of mounting, the installation can be easily moved up or down in the bin to operate at different levels or lifted out for inspection. The Bin-Dicator Co., 13946-59 Kercheval, Detroit 15, Mich.

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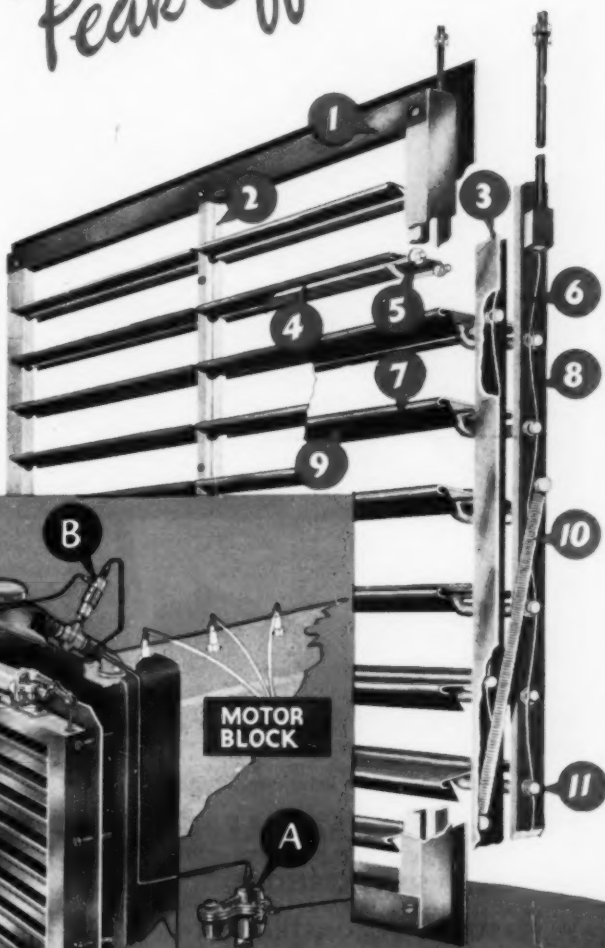
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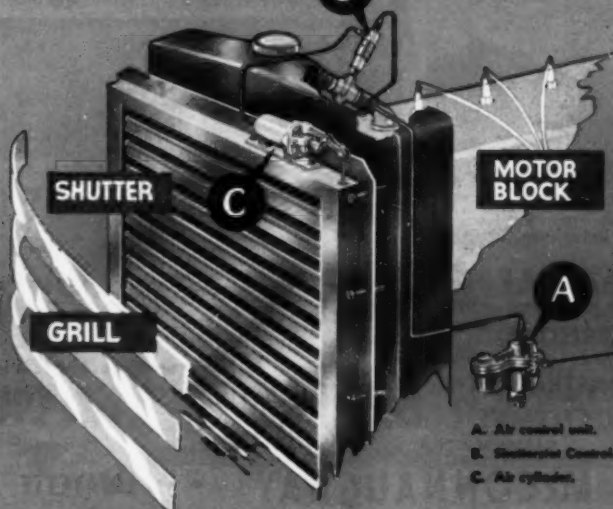
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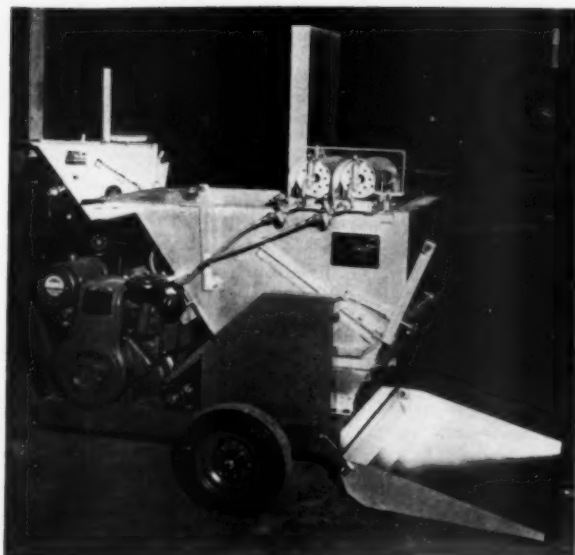
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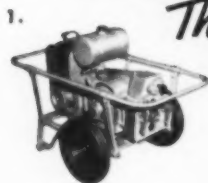
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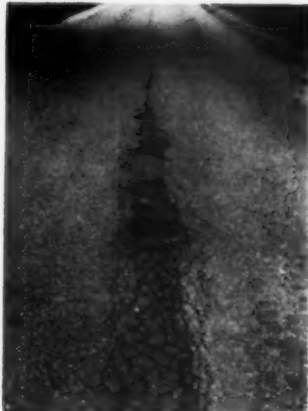
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★ Vermont is taking steps to avoid centerline deterioration

More On Vermont

(Continued from page 68)

caused a great deal of trouble from stripping. The addition of these materials and an increase in the curing time before the patch is used has helped produce satisfactory results.

The accompanying photos illustrate two points of interest.

One illustrates the difference in texture of surface when using $6\frac{1}{2}\%$ per cent asphalt content as compared to $5\frac{1}{2}\%$ per cent. In 1949 we placed some bituminous concrete, using $5\frac{1}{2}\%$ per cent asphalt. Experience evidenced that the aggregate was not too thoroughly bonded by this quantity of asphalt and there was a tendency toward porosity and raveling, particularly where only one course of pavement was laid and where joints occurred in the old concrete pavement underneath. Vermont endures cold winters and frost action may have played its part when water penetrated the pores of the pavement and froze. Increasing the asphalt content by one per cent seems to have helped this condition, producing a well bonded and water-tight surface.

Extreme care must be used in not exceeding a 7 per cent asphalt content or a slippery road metal may result from blading and from rainy weather. Fluctuation in fines may call for minor adjustments in asphalt content.

The second photograph indicates the type of deterioration which may ensue from poor distribution and compaction of the bituminous mix along the center line where the left and right paving strips are joined together. This, coupled with low asphalt content, may

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lead to serious disintegration of the bituminous pavement. To avoid this sort of breakdown we are now cutting back the edge of the first laid course sufficiently so that it exposes an even and vertical edge with full thickness. Thus the second course of pavement can be butted against a uniform edge. This results in uniform thickness along joint areas which, in turn, results in uniform and thorough compaction when rolling.

All longitudinal and transverse joints are given a light paint coat of emulsified asphalt, Type RS-1, conforming to the requirements of A.A.S.H.O. Designation M 140-49, just prior to the placing of any adjacent course.

The one per cent increase in asphalt content for the bituminous concrete also favors the making of a dense and non-porous pavement along joint areas.

Alabama

By J. L. Land, Chief Engineer, Bureau of Materials and Test, State of Alabama² Highway Department, Montgomery.

The following brief outline covers bituminous developments in our state highway program.

1. Intensive soil studies to promote more intelligent use of soil in sub-

grades; the studies cover such subjects as compaction; improved drainage to secure uniform bearing in subgrade; and base construction using either natural deposits alone, or blends.

2. The use of roadside or nearby materials for asphalt plant-mix surfacing, ranging from bank-run sand to crushed aggregates, with a great deal of emphasis being placed on studies of the effects of breaks in gradation, rounded particles, colloids, stabilities, and grades of asphalt.

3. Improvement in foundation design to meet requirements. Alabama department engineers have not been so much worried with base thickness design methods as in gauging the anticipated traffic. Some trouble has been encountered on secondary roads being subjected to unpredictable conditions of detours, etc. These are only minor or negligible cases. Properly designed foundation courses become better and stronger under traffic.

4. Developments indicate that secondary low cost roads must carry alignments, grade lines, and foundation courses not only under current usage but predicted traffic growth to pay dividends. Our rural areas are developing and it is difficult to forecast the end. Such policies as embodying the use of local materials and adequate design are followed to insure

sound, economical investments and prevent subsequent costly renovations.

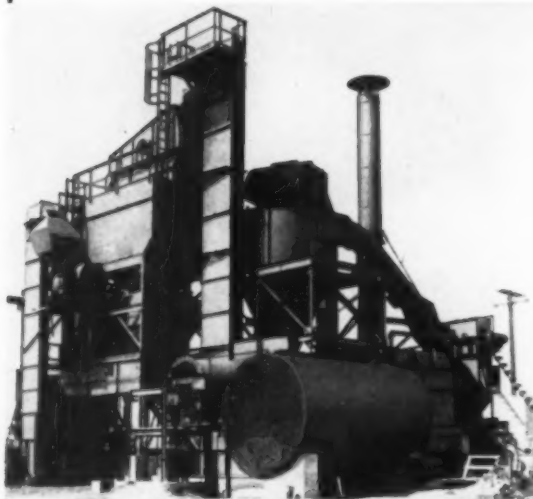
5. As with other states we are renovating obsolete roads. The method, design and question of when to renovate are very controversial. Much of the work involves the widening and covering up of concrete pavements with bituminous materials. Many times the grade line, etc., limits or controls operation and only light applications can be placed. However, where possible, covering the old pavement with a flexible base, and use of asphalt mix surface for full width of improvement, has proven the best.

6. With advancement in road types, engineering, design and inspection have kept improving and are more highly developed at present than at any time before, as to use of quality and type of bitumen, use of aggregate, use of soils, construction methods, and field control.

Paper Snow Fence

An experimental section of rather unusual snow fence was installed this winter on State Highway No. 25 near Mandan, North Dakota. It consisted of steel posts with two 12-inch strips of heavy paper, manufactured by the Sisalkraft Company.

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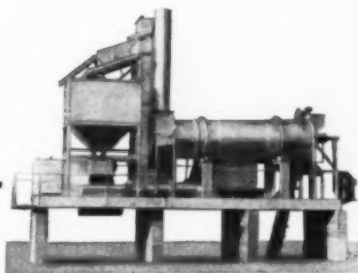
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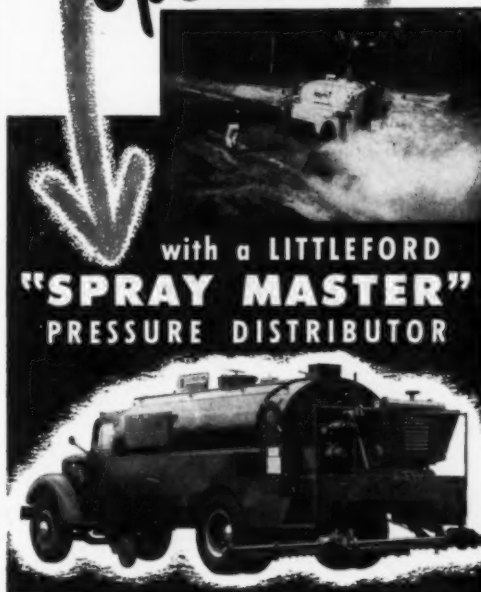
Sizes: L-12, 12-15 tons per hour. Will pave 25' street, 2" thick, one 300' block per day. L-25, 25-30 tons per hour. Will cover 20' road, 1" thick, at ½-mile per day.

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**MORE LOADS PER HOUR—
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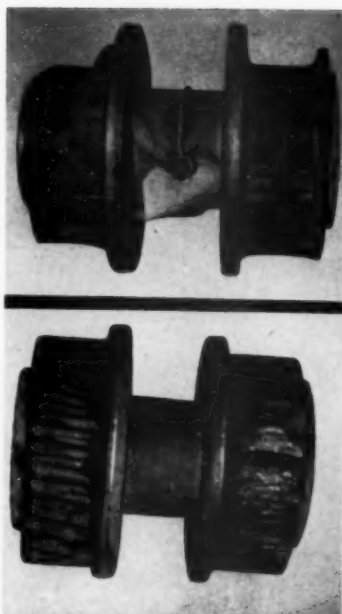
What About Top Carrier Rolls?

The past year has seen an enormous increase in the acceptance of the automatic electric welding method of rebuilding and hard-facing worn tractor parts, notably rollers and idlers. This is due in part to the shortage of replacements, but chiefly to the economies of this process—lower cost, longer service life, less down-time of the equipment.

Questions as to rebuilding procedures for top carrier rolls have recently become more and more frequent. Although the carrier roll has much the same appearance as the larger roller on which the tractor runs, top rolls are usually cast iron rather than steel and hence not generally considered

suitable for rebuilding by the automatic process. In the case of cast steel rolls, automatic welding, using a wire such as Stoddy 105, produces the best results.

For cast iron top rolls it has been found that the most satisfactory procedure is the manual application of an electrode having properties particularly suited to the rough usage these rolls get, i.e., an electrode (such as Stoddy 1027) with high impact strength and resistance to severe abrasion. On a tractor operating in mud, top carrier rolls will often freeze up and, by the time they are freed, the track has worn a flat spot; when rolls are properly rebuilt, wear is far less and usually no flat appears. Costs of labor and material are considerably below replacement price—and service life is usually superior to new parts.



★ Top carrier roll, shown in worn condition and (lower scene) after rebuilding with hard-facing materials



DARAKOTE enables you to continue surface treatment, cold-patch and repair work right through the late Fall . . . despite cold, wet weather!

Highway Departments throughout the country lengthened their paving season last Fall by using DARAKOTE—the anti-stripping agent that makes it possible for liquid bituminous materials to stick to cold, moist aggregates.

DARAKOTE prevents stripping under these adverse conditions, even during heavy Fall rains, by actually displacing the water from the surface of the rock. It permanently binds asphalt to the aggregate and to the road surface. It works equally well with asphalt cements, cut-back asphalts, road oils, road tars . . . on both acidic (siliceous) and basic (calcareous) types of paving aggregates.

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Frederick E. Everett

Frederick E. Everett, 75, retired New Hampshire State Highway Commissioner, died suddenly September 18. Up to his retirement two years ago, Mr. Everett was dean of New Hampshire state officials. Appointed the state's first highway commissioner in 1915, he served in that capacity for 35 years.

Mr. Everett received the George S. Bartlett award for outstanding engineering achievement from the American Society of Highway Officials, American Road Builders' association and the National Research council in 1946. He was a member of the executive council of the American Society of Highway Officials for 15 years and served as its president in 1934.

Comments from our Readers


To the Editor:

I have read the Seal Coating editorial in September ROADS AND STREETS and was favorably impressed. I think it translates the conclusions to be drawn from the technical and engineering situation into very plain

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For repair and secondary construction. Both truck and trailer mounted units are available.



Rear Mounted Model RRE

and effective language for highway administrators and executives. It is the type of thing badly needed. Incidentally, I thought this whole September issue a very excellent one.

Generally speaking, I think the approach you are following in this matter is a real contribution in the highway field. I am being forced to the conclusion that the great store of practical knowledge and empirical approaches available to the construction and maintenance of flexible surfaces is reaching its limitations. The subject is too complex for indefinite advancement without accompanying engineering analysis and techniques. These are beginning to appear and outstrip their application and utilization in practice. Consequently the critically needed item is interpretation of this rather difficult (because of the number of variables) technology to the men in highway work, most of whom cannot and should not have the involved engineering background required to fully understand the theory. This interpretation must take two forms. One is the need of technical articles which will translate the scientific facts into practical methods—although this cannot be done without some understanding and use of the fundamental information by those engaged in it.

The other, and probably a necessary antecedent to the former, is an understanding by the executive group that better results are possible, that they can be obtained without extra expense or will pay off handsomely for such as is required, and therefore that the better practices must be adopted as a matter of policy. The contribution which you can make in this educational program is obvious and your editorial is a good start.

H. G. Nevitt, Manager,
Asphalt Department,
Central Region,
Socony-Vacuum
Oil Company, Kansas City

CUT YOUR SOD MECHANICALLY —faster, better, cheaper—with a PHILLIPS POWER SOD CUTTER

This type of machine has been in regular, successful and profitable use on state highways for ten years. Cutting a strip of sod 16 inches wide, it can cover from 1 to 2 acres daily. Its oscillating action, powered by an 8-horsepower Briggs & Stratton engine, gives efficient and economical results in steady, day-after-day service.

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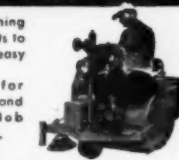
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3 New Ways to Cut Costs with Le Roi TRACTAIR (Tractor-Compressor)

Tractair with its combination tractor-105 compressor feature and its many attachments has provided money-saving usefulness for contrac-

tors, utilities, and municipalities everywhere. Here are 3 new attachments that have already proved their ability to reduce costs:



1 Tractair Backhoe saves on small digging jobs

It gives you air power for breaking through pavement, frost, or running other air tools. Then the hydraulic backhoe takes over — does your digging fast and easy to a depth of 8 feet. Plenty of power for roots, broken concrete or hard ground. Digs straight end walls and loads to a height of 6'2".

2 Tractair Patch-Drill saves on pavement patching and trench opening

This unit consists of an air-feed Le Roi-CLEVELAND H-10 sinker (45 lb). It permits easy, fast drilling of a succession of holes. Then, using the same machine, all you have to do is broach out the web between the holes and lift out the entire section of pavement. There is no loading problem — no shoveling. Holes can be drilled and broached in an 8' radius. Tractair supplies air power, mobility, and, when equipped with front-end loader attachment, lifting power, too.



3 Tractair Multiple Tamper saves on tamping operations

Thanks to Tractair mobility, the tamping effectiveness of the Le Roi-CLEVELAND 3-Tamper arrangement and work-saving air feed, this unit can keep up with three men shoveling or a back-filling tractor. Not only is tamping faster and easier, but you also get better compaction and lower costs.

Learn more about the money-saving usefulness of Tractair for your own type of work. Send today for the 70-page, information-packed Tractair application book.

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Roebling makes a complete line of wire rope . . . offers the right grade and construction for every installation. Have your Roebling Field Man help choose the *right* rope for your equipment. Get his advice on the correct use and maintenance of wire rope. It is based on performance records on thousands of installations. John A. Roebling's Sons Company, Trenton 2, New Jersey.

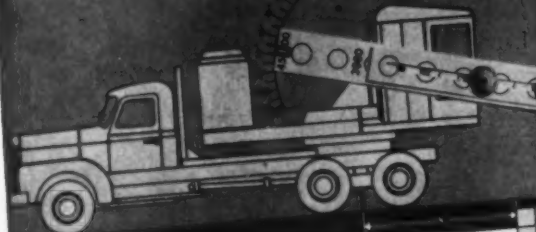
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Gradall handles—simply and speedily—more types of construction work than any other machine.

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Magennis Heads International Road Federation

The board of directors, International Road Federation, American region, have elected Frank T. Magennis as chairman.

Mr. Magennis is vice president of the Goodyear Tire and Rubber Export Company, of Akron, Ohio. He succeeds B. C. Budd, vice president, Packard Motor Car Company, Detroit. Mr. Budd served as chairman since the Federation was founded in 1948, will continue as a director.

Sponsored by oil, motor, rubber and construction equipment interests, the Federation maintains regional offices in Washington, Paris, and London and serves as a clearing house for affiliated national good roads associations in more than thirty countries. It is currently helping in the organization of additional associations in some 20 other countries.

The Federation coordinates and disseminates world-wide technical, economic and social information on highways and highway transportation and augments the work of its affiliated groups in the education of governments and the public in the social and economic benefits derived from good road systems and maximum use of highway transportation. It supports a fellowship program for advanced training of highway engineers and cooperates with its affiliates in the training of nationals.

Recently, the Federation inaugurated a survey of Latin America, the Indian Peninsula and the Near East for the Point IV Administration to determine technical assistance requirements for highway development in these areas.

Bridge Raised

(Continued from page 37)

needed to operate them and direct traffic. The photos show the lights, these pictures being taken after the raising was completed and while the slag approach ramp was being removed on one side of the roadway for construction of the new approach span. During this phase traffic control was aided by signs reading "One Lane Traffic, Wait for Signal".

Traffic control was maintained 24 hours a day when necessary, and at the end of each day effort was made to put the work in best possible order to insure against traffic mishaps at night.

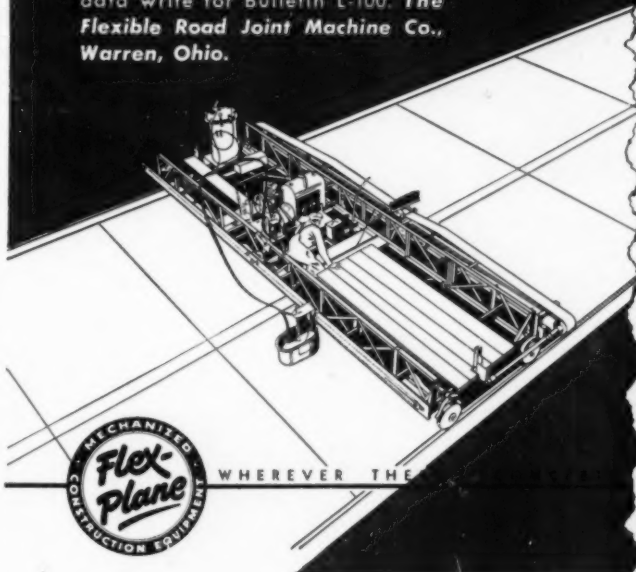
The project is under the Chillicothe district of the Ohio department of highways, with Clarence S. Elicker, project engineer for the state and R. B. Skaggs, superintendent for American Bridge Company.

FLEX-PLANE Automatic Curing—point for point—is the one best way to cure concrete. FLEX-PLANE doubly sprays each square foot of concrete—uniformly—without material waste. A single machine can be easily and quickly adjustable to any width work

—and, with three forward speeds it is easily regulated to job requirements.

FLEX-PLANE applies any type curing compound through a special traveling **single** nozzle that is easy to keep clean, assuring complete coverage and uniform application. And, FLEX-PLANE with brooming, belting or traffic line marker attachments can do more than one job at a time—further reducing construction costs.

Such operating economies—plus the low initial cost—is why more and more engineers and roadbuilders are convinced FLEX-PLANE is automatic curing at its best. For more complete data write for Bulletin L-100. **The Flexible Road Joint Machine Co., Warren, Ohio.**



17 Years Young
and
3,100,000
Cubic Yards
to show for it!

126-S Worthington-Ransome Big Mixer at Arundel-Brooks Concrete Corporation's Wolf Street plant, Baltimore, shows hardly any sign of wear after having poured 3,100,000 cu yd in its 17 years.



Worthington-Ransome 126-S discharging full 5 cu yd batch in approximately 30 seconds.



One of Arundel-Brooks' 6½ cu yd agitators pouring a retaining wall at General Sam Smith Park, being built to relieve traffic congestion at Light and Pratt Streets, Baltimore.

In 1950—its 17th year—this veteran concrete mixer poured more than 250,000 cu yds on a single set of liners!

This extraordinary performance of a 126-S Worthington-Ransome Blue Brute concrete mixer is attested to by Arundel-Brooks' records. The machine, given proper maintenance over its lifetime, shows virtually no wear after uncounted hours of profitable service.

Arundel-Brooks operates two other Worthington-Ransome Big Mixers—

an 84-S at the Sparrow's Point plant, a 56-S at Brooklyn, Md.

And eight of the company's growing fleet of truck-mounted agitators are Worthington-Ransome Blue Brute Hi-Ups, considered "highly satisfactory in every respect."

These eight are used for most long-distance hauls because their light weight* permits carrying a maximum payload with strict adherence to highway load limits.

FIND OUT WHY THERE'S MORE WORTH IN WORTHINGTON

See your nearby Worthington-Ransome distributor. Worthington Pump and Ma-

chinery Corporation, Construction Equipment Sales Division, Dunellen, N. J.

*7,290 lb for the standard 4½ cu yd truck mixer, as little as 6,700 lb for 6½ cu yd agitator models.

WORTHINGTON



BUY BLUE BRUTES

You'll find you, too, can get the real performance plus from Worthington and Worthington-Ransome Blue Brutes—a broad line of construction equipment noted for the rugged quality your type of work demands.

R-1-1



IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

(Continued from page 48)

led to its extension to cover the entire Commonwealth.

A frequency modulated network of radio-telephony is used. The central station is on the top of a mountain north of Harrisburg. Each county has a fixed station. Elk and Cameron Counties are operated jointly, therefore the total of these stations is sixty-six. The eleven engineering districts each contain one combination transmitter and receiver in the official automobiles of the district engineer, his maintenance engineer and the district mechanic. In the counties the automobiles of the maintenance superintendent, his assistant and garage foreman likewise contain combination receivers and transmitters.

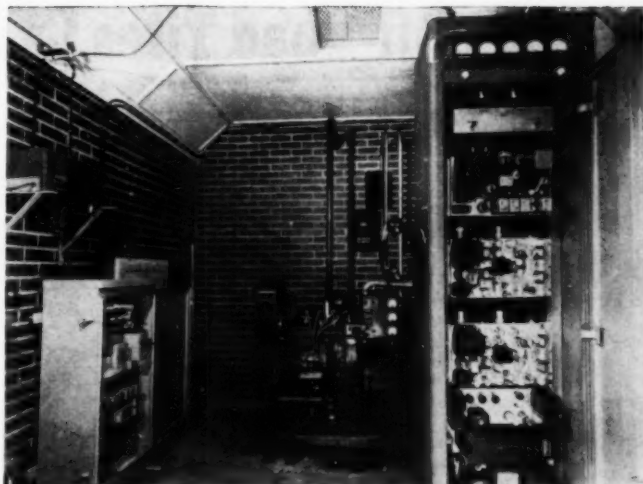
At Central Headquarters in Harrisburg the automobiles of the assistant chief maintenance engineer and an assistant are radio equipped.

Now 350 Transmitters

The total of transmitter-receivers is 350 at present and authority has been secured from the Federal Communications Commission to increase the number to 650 stations, if and when needed.

Operators of the land stations as well as the mobile units have been licensed by the FCC. To increase the efficiency of the operation, standard operating procedures have been established, a phonetic alphabet set up and codes arranged to insure rapid and accurate transmission of messages.

By a system of relays it will be possible to transmit and receive messages from the most remote parts of the Commonwealth. Thus the men in immediate supervision of the snow removal forces and the cinderling



★ Inside the central transmitter station, which is shared by the Pennsylvania Department of Highways and the Pennsylvania State Police

crews will be closely tied together in a virtually instantaneous system of communications. They may quickly transfer equipment within the county to meet emergency conditions. They may call on adjoining counties for help or appeal to their district engineer or central headquarters in Harrisburg as occasion demands.

Practically all highways carrying 100 and upward vehicles per day are included in the initial snow removal program. After these approximately 21,000 miles are cleared the plow and cinder crews will move to the lesser traveled roads on the principle that mails, school buses and similar vehicles must be able to get through, with a minimum of delay.

An estimated 4,416 units of Department-owned equipment are employed in snow removal and application of abrasives. In addition, 2,763 plow-equipped trucks and other vehicles have been leased to bring the total to 2,426 trucks, 2,572 blade and V-type plows; 27 rotary plows, 10 Snogo plows, 309 miscellaneous plows and plowing units; 108 tractors, 1,505 wagonettes, 392 graders, 42 bulldozers, 91 miscellaneous units. Close supervision over both Department-owned and leased equipment is maintained by the Equipment Bureau.

In a State-wide storm this equipment plus the entire maintenance force and emergency hired manpower (Continued on page 88)



★ View of the radio power equipment installed in an automobile of the Pennsylvania Department of Highways



★ John P. Henry, assistant maintenance engineer, manning a land station

Making Off-Road Tires Last Longer

*Watch Inflation, and Take Better
Care of Your Haul Roads*

By J. A. Beckett

Manager, Field Service & Engineering,
The General Tire & Rubber Company

IT only takes a casual investigation to prove that the two greatest hazards to which off-the-road tires are subject are lack of inflation attention and poorly maintained roadways.

Too many operations either have no airing facilities at all or are trying to get by with compressors that aren't large enough to inflate medium size truck tires efficiently, let alone a giant 21.00/24. The result is that even where there is a tire inflation program lots of times the service man is pressed for time and goes on to another tire before one is completely inflated to its proper pressure. The loss of one 18.00 or 21.00 tire through lack of proper inflation will cost as much, or more, than a portable compressor of sufficient size. Not only is the loss of the tire costly, but time lost by the equipment while a replacement tire is being applied can sometimes run into hundreds of dollars.

Large Valves Developed

Because of the large volume of air contained in big off-the-road tires, inflation will always be slower than, say, with a 10.00/20 truck tire. Tire manufacturers realize this and in an effort to help the situation have developed the Jumbo type valve. The bore of this valve is just about twice the size of an ordinary valve and thus will make it possible to inflate or deflate a large tire at least four times as fast as with an ordinary valve. These Jumbo valves are not in general use as yet although a large portion of the new equipment built during 1951 uses the Jumbo valve as original equipment.

Tubes in sizes 14.00/24 and larger can be secured with Jumbo valves from your supplier. The valve number and bend, if any, must be specified on the order. These valves cannot be bent by ordinary methods commonly used in the field. Bending must be done at the factory through the use of special equipment. Replacement parts such as valve cores, caps, and repair valves can be ordered through your regular source of supply. Gauges, chucks, and service tools for Jumbo valves are also available.

In addition to the advantage of quicker inflation and deflation with



★ Watching inflation and maintaining good haul roads are among chief ways to prolong tire life

Jumbo valves, there is another advantage that cannot be overlooked. The increased size of the valve makes it stronger and stiffer, thus preventing bending and breakage in rough service. These two advantages should materially increase tire life by allowing quicker and more efficient inflation and the reduction of on-the-job tire failures and subsequent delays.

Double Tire Life

Maintaining of good roadways is looked upon by some operations as a needless expense. Sure—it costs money to keep a patrol grader in service but the results more than merit the expense. On one operation with which we are familiar, tire life more than doubled after a grader was put into service on road maintenance only four hours a day.

A tire is only as good as the roadways on which it operates. A few ton of gravel or crushed stone spread properly in low spots where water accumulates after a rain can reduce tire cutting and chipping tremendously. A puddle of water with a few rocks that have fallen off a previous load thrown in for good measure presents an ideal setup to gash a tire wide open on the truck that follows. Wet rubber cuts ten times as easy as dry rubber. Try it yourself with a dry knife and then a wet one. It is conditions like this that are often overlooked and even scoffed at that can add an extra zero to even

a medium sized operator's tire and repair bill.

Off-the-road operations such as road or airport grading, logging, quarrying, strip mining, etc., are big business and spend big money keeping rubber on the ground so the wheels can roll. By following just a few good common sense rules of tire service, much money that is now wasted in premature tire failures can be converted into reduced tire costs and extra profit.

(Continued from page 87)

of 22,000 men will swing into action.

As a drift preventative measure 14,725,450 feet of snow fence will be erected before mid-November. This equipment has been repaired and made ready for another season's use. Twenty-five miles of evergreens are planted experimentally.

Cinders and similar abrasives are stockpiled during the summer in ample quantities at or near places where they will be spread. The Department has been experiencing difficulty in obtaining cinders in the required quantity of 600,000 tons. In some localities sand is used as a substitute. Crushed slag is also used.

The plan calls for plows to be installed, snow fence erected, abrasives stockpiled and all other preparations completed for the annual battle not later than mid-November.

B.F. Goodrich



This tire has a built-in rock-absorber

LAMBERT BROS., INC., of Knoxville, Tennessee, are engaged in quarrying operations in Tennessee, North Carolina, Georgia and Virginia. Trucks used in their operation travel in and out of the quarries, carrying heavy loads of dynamited limestone to the crusher. Pictured is one of the dump trucks at the Shepherd, Tennessee branch of the company (above), equipped with B. F. Goodrich Universal tires. Through the use of these tires the company says that better traction is obtained and that they hold as well in one direction as in the other. And the special construction provides unusual bruise resistance when travelling over rocks.

BFG Universals are ideal for tough-

est off-the-road service. They turn in top performance records even where rock, shale, stumps, ruts and other hazards are tire threats. Wedge-shaped tread resists cuts. Sidewalls are reinforced with tough, extra-thick rubber. The backbone, or body, of the tire is protected by the patented *nylon shock shield*. It acts as a shock-absorber—or "rock-absorber". And here's where you get extra bruise resistance. Strong, live, elastic nylon cords are built in between the tread rubber and the cord body. Under impacts of any kind, these cords work together, absorbing and distributing the shocks.

This feature is found in all BFG tires of 8 or more plies at no extra

cost. Double nylon shock shield is used in Universals of sizes 11.00 and larger.

B. F. Goodrich tires are built for every type of on or off-the-road operation. No matter what your specifications may be, you'll find that your local B. F. Goodrich dealer can show you the way to longer and better tire service. The B. F. Goodrich Company, Akron, Ohio.



AASHO Meeting

(Continued from page 38)

lems. These Anderson noted and commented on:

1. How to attract and hold the talented young men and women into highway work, needed to cope with the complex problems of this gigantic field. The methods of the more successful departments should be studied.

2. Toll roads—what shall be the policy? It is hard to conceive that both toll and free roads can long survive in competition. One form must perish. History will give the answer. Meanwhile, a drastic overhaul of our present widely held philosophy of highway finance and operation must be faced.

3. Problems of the highway departments are taken for granted by too many people. County, township and city highway authorities as well as state must better understand the relationship between highway transport and education, industry, agriculture and our entire economy and way of life.

4. The proper size, speed and weight of commercial vehicles should be known—together with schedules of fees, penalties and road regulations.

5. Accident reduction is a chief problem. The low accident rates achieved in some states should be possible in all states.

6. What funds are required for roads? Gasoline tax rates are little raised in ten years (only 13%). The public that opposes a raise of one cent in gas tax rate (.07 cents a mile) will cheerfully at this time pay 15 times as much to ride a toll highway. Tax methods and ways of selling them must be explored.

Equipment and Material Notes

(Continued from page 70)

Radiator and Water Cleaner

A new device to protect automotive engines against serious overheating due to faulty cooling systems has been introduced by Fram Corporation. Known as the Fram Radiator and Water Cleaner, the device fits trucks, tractors, cars and buses. It is claimed to inhibit rust and corrosion in the cooling system, to soften coolant water to stop scale deposits, and to filter rust, scale and foreign particles from the coolant. It is stated to guard the cooling system against severe overheating, frequent cause of scored pistons and cylinders, burned valves, cracked blocks and heads, as well as other troubles

requiring expensive repairs. The Fram Radiator & Water Cleaner functions simply but effectively: A controlled amount of water flows continuously from the cooling system and enters the cleaner. Water contacts the softening and inhibiting chemicals in a replaceable cartridge, and passes through a filtering media where solids are removed. Filtered, softened water containing soluble inhibitor re-enters the cooling system and circulates throughout, with the result that coolant is free of particles, cannot cause scale deposits, rust or corrosion. The action of the Fram Radiator & Water Cleaner is absolutely harmless to antifreeze and other radiator chemicals. Fram Corporation, Providence, R. I.

Automatic Gang Drill

A combined drilling machine designed to advance the face of a drift or tunnel 10 ft. at each set-up, with all drills operating simultaneously as a single unit, has been developed by Demo and Cannon Engineering and Manufacturing Co., Inc. The pattern adopted for the first unit, which has been sold to the Mexican Government, was suitable for driving a tunnel in rock 6 ft. 9 in. wide, with an arched roof having a total height of 7 ft. 6 in. The corporation is prepared to construct machines for use in driving tunnels of other sizes and shapes. This unit has 28 drills and a self-contained power plant suitable for mounting on mine flat car or suspended from a monorail track attached to the roof of the tunnel. The machinery is mounted as a unit on a channel iron base and with a rigid framework.

The twenty-eight electric hammer drills are fully automatic in rotary motion and forward drive. They operate as a single unit. The drills are grouped in 7 banks of 4 drills each and driven off a single drive shaft through universal chain drives. The outside row of drills are adjustable and may be moved in vertical or horizontal direction to give a variable pitch of $4\frac{1}{2}$ in. to 10 ft. from direction of drive. All other drills are in fixed position parallel to direction of drive. This permits a standard drilling pattern with burn cut center. The bits are of the hollow core drilling type constructed from chrome-moly steel and mounting inset cutting teeth of high speed tungsten carbide steel. The drill stem is of hollow steel with overall diameter of 2 in. The holes drilled are $2\frac{3}{4}$ in. in diameter. Water and air are fed to the cutting edge of bit for the purpose of cooling and removing cuttings.

The cuttings drop out as core flakes or are discharged out of the drill cylinder as solid cores, depending on the

nature of the rock drilled. The length of stroke of the drill is $3/32$ in. The cutting rate as determined by single drill test is 1 ft. per minute. Actual test runs indicate drilling speeds of 7 in. to 36 in. per minute in quartzite. The estimated life of a bit in hard quartzite is 700 lin. ft. of drill hole. The drill strikes three blows for each revolution of the bit. The drill speed is adjustable, and can be driven from 300 to 3000 revolutions per minute.

This wide range of speeds permits adjustment to a suitable drilling rate for tough, hard or soft rock. The power requirements are as follows: Operation of drills, 10 h.p.; compressor, $7\frac{1}{2}$ h.p.; hydraulic jacks, 1 h.p.; screw drive, 1 h.p.; high pressure water pump, 1 h.p.; tram motor, 1 h.p.; total, $21\frac{1}{2}$ h.p. The electrical controls are of the push-button type and are centered in the dashboard of the cab in the rear of the drilling machine. Comfortable and adjustable seating for the operator or operators is arranged in the cab within easy reach of the operating panel. Demo and Cannon Engineering and Manufacturing Co., Inc., 2215 South Sepulveda Boulevard, Los Angeles 64, Calif.

365 Cu. Ft. Compressor

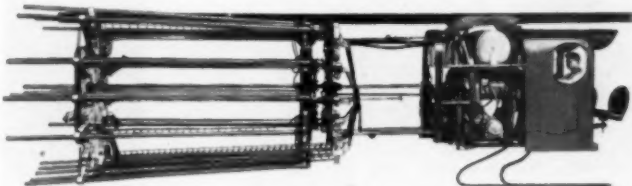
A new standard model 365 air compressor has been added to the line of the Jaeger Machine Co. The new compressor, rated at 365 cu. ft. of air per minute at



New Jaeger Standard Model 365 Air Compressor

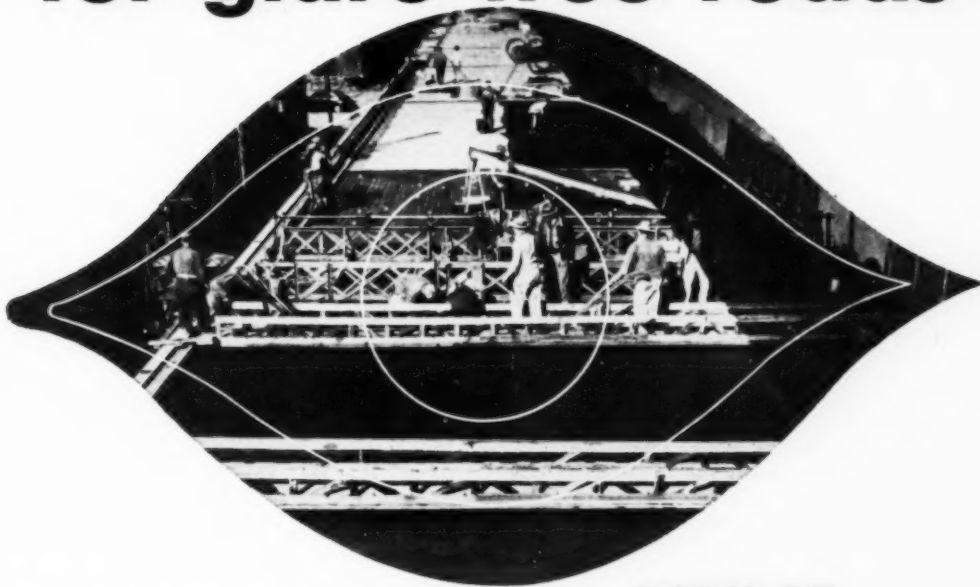
100 lbs. per square inch pressure, utilizes a 165 h.p. Model HRBI-600 Cummins Diesel for its power plant. Engine operating speed of the Diesel-compressor unit is 1240 r.p.m.

The compressor is mounted on structurally welded main frames. The heavy duty wagon has an "auto-steer" front axle, and can be hauled safely at 55 miles



Demo and Cannon Automatic Gang Drill

for glare-free roads



Reduces the ice buildup on Air Entrained concrete roads because of greater heat absorption by the dark surface.

Surface cracking reduced because the surface is more uniform in temperature.

Permanent road markers are more visible against grey tinted Air Entrained concrete, resulting in greater safety.

HORN AE Dispersed Black

is used in darkening
air entrained concrete highways,
sidewalks, pavements and
center islands.

Easy to Use—
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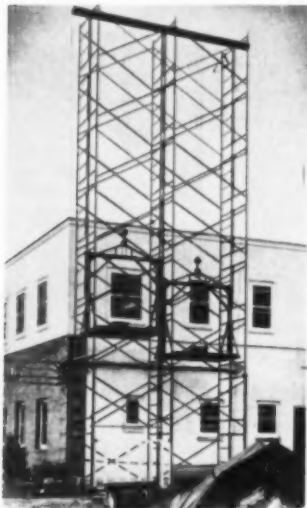
CITY _____ STATE _____

When writing advertisers please mention **ROADS AND STREETS**, November, 1951

per hour over rough roads. Steel wheels or skid mountings are also available. Length of the complete rubber-tired unit is 12 ft., 3 in.; width, 5 ft. 10½ in.; height, 6 ft., 9 in.; and weight, 8,500 lbs. The Jaeger Machine Co., 223 Dublin Ave., Columbus 16, O.

Material Hoisting Tower

A new Waco material hoisting tower that assembles with standard Waco sectional scaffolding has been announced by the Wilson-Albrecht Co., Inc. The tower is available as either a double-well or single-well unit and can be erected in approximately 2½ hours by three men. The unit features remote or pre-set plat-

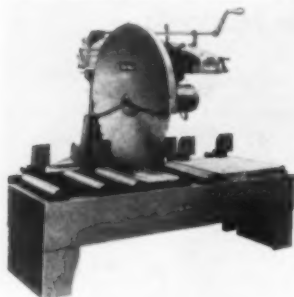


Waco Double-Well Material Hoisting Tower

form control and the double-well tower is designed for simultaneous loading and unloading at top or bottom of alternate wells. Other features include a "slow-up" brake on the power mechanism to govern platform descending speed, and a safety slack brake which sets automatically in case of failure in the hoisting rig. Wilson-Albrecht Co., Inc., 3565 Wooddale Ave., St. Louis Park, Minn.

Timber Cutter

A timber cutter that can cut 12 x 18 timbers in the cross cut position and

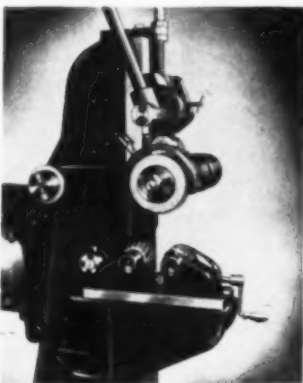


De Walt Timber Cutter

12 x 12 timbers in the 45 miter position has been announced by De Walt, Inc. Powered by a 10 h.p. direct-drive motor, the timber cutter has such noteworthy features as an unusually rugged arm and column, operating levers located within easy reach of the operator, and a segmental back guide that permit rapid change over from cross cutting to mitering. A 36 in. diameter saw blade operating at 1800 r.p.m. is the standard cutting blade. De Walt, Inc., P. O. Box 540, Lancaster, Pa.

Pipe De-Scaler and Cleaner

A new pipe and tube de-scaling and cleaning attachment for its Steen cut-off machines has been announced by Continental Machine Co. The attachment



Continental Pipe and Tube De-Scaler

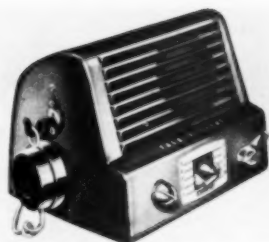
cleans rust, scale, paint, and other deposits off pipes, posts and building columns. Sizes are available for cleaning pipes up to 12 in. in diameter. It is especially adapted for reclaiming used pipes and tubes. Most work requires only one pass through the rollers to completely remove all deposits. It feeds up to 20 feet of pipe per minute. Continental Machine Co., 1952 N. Maud Ave., Chicago 14, Ill.

Snow Plow Wax

A new special "spray grade" of Snow-Rem liquid snow plow wax for fast spray gun application on snow plow wings and moldboards has been announced by Speco, Inc. This will be a companion product to standard Snow-Rem which is applied by hand with a paint brush. Like standard Snow-Rem, the new spray grade possesses a high Carnauba wax content. It also contains new silicone resins which are reputed to produce a smoother, long lasting water-resistant surface than has previously been achieved. Speco, Inc., 7308 Associate Ave., Cleveland, O.

Intercommunications System

A new intercommunications system, combining many features of the Talk-A-Phone master-selective and deluxe models, has been introduced by the Talk-A-Phone Co. The new Talk-A-Phone CL Series is stated to offer for the first time in the low price range a flexible combination from which incoming calls may be answered from a distance of up to 40 ft. from any master station or sub-station, and in which master stations may talk with each other, sub-stations may be called selectively, or exclusively to any



Talk-A-Phone CL Series

master station, and any master may be used privately or non-privately at its own option. Talk-A-Phone Co., 1512 S. Pulaski Rd., Chicago, Ill.

Full-Revolving Derrick

A new self-contained, full-revolving derrick, announced by Clyde Iron Works, Inc., has a short tail swing of but 5 ft. 6 in. and requiring no stiff-legs or guy lines, it occupies a minimum of ground

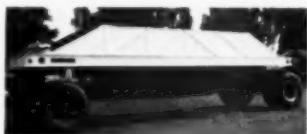


Model W-3 Full Revolving Derrick

space which permits it to be set up and operate in congested areas. The rotating structure which supports the boom and boom supporting members also supports the hoisting machinery. This helps provide counterweight for additional stability when swinging loads. The complete rotating structure is centered on a cast steel turntable by means of a bronze bushed center pin and is supported by 4 double tapered, anti-friction bearing rollers. Boom lengths of 20, 30 or 40 ft. are available with load capacities from 2000 lb. at 40 ft. radius to 10,000 lb. at 10 ft. radius. The derrick is available with either gasoline or electric power and can be hand or power. Clyde Iron Works, Duluth 1, Minn.

Center Dump Semi-Trailer

A completely new design of its center dump semi-trailer has been announced by Omaha Standard Co. A separate adjustable latch mechanism, mounted in protected position on the side of the body, is provided for each pair of doors



Omaha Standard Center Dump Semi-Trailer

HOT BITUMEN FROM TANK-CARS

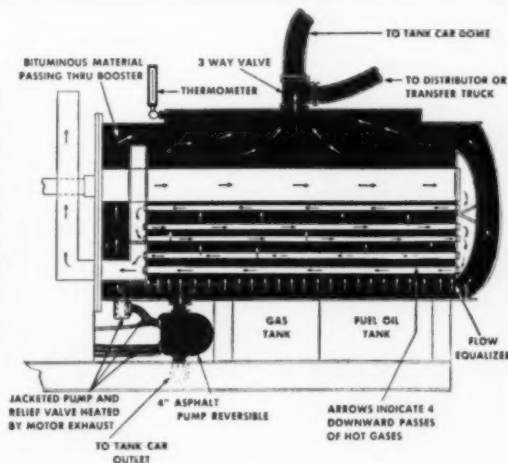
4 times as fast with



a Cleaver-Brooks PORTABLE PUMPING BOOSTER

The inside reason for fast operation:

Cleaver-Brooks Pumping Boosters pump, heat, and circulate bituminous material in one operation. Heating is provided directly, without use of steam, by pumping from tank-car (or storage tank) through the heating element of the Booster and back into tank-car. Entire contents of tank-car need not be heated as in one pass through the Booster, bituminous materials are heated to application temperatures and delivered to distributor, transfer truck, or storage tank; circulation of material while heating prevents separation and assures uniform application. No water or steam required for operation.



Built by the pioneers and originators of pumping boosters:

Cleaver-Brooks Pumping Boosters are available in two sizes (No. 1 heats 10,000 gal. car 35° — 45°F. per hour; No. 2 heats 10,000 gal. car 55° to 65°F. per hour); both sizes obtainable skid-mounted or trailer mounted. Cleaver-Brooks are pioneers and originators of pumping boosters and tank-car heaters — have designed and built this equipment for more than 20 years — many original models are still in action — rendering efficient service.

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Send for bulletin "Cleaver-Brooks Pumping Boosters" for complete information and specifications.

BUILT WITH THE FAMED
FOUR-PASS HIGH EFFICIENCY DESIGN OF

Cleaver-Brooks

STEAM BOILERS



and allows the operator to preset the opening of the dump doors anywhere from 4 to 36 in., to provide an even, metered flow of material while dumping. The latch can be adjusted with the doors open or closed. Hopper bottoms are especially designed for the most efficient handling of the materials specified by the purchaser. Main frame members pass outside the hopper, leaving it clear of obstructions and interior bracing, preventing any tendency of the load to bridge or clog. Body side walls are braced with bridge-type trusses of angle iron and run the full length of the trailer to provide maximum strength and rigidity with light weight. Omaha Standard Co., Council Bluffs, Ia.

Coupling Unit for Power Systems

Motorola, Inc., has announced the introduction of the Aperiodic line coupling unit which makes use of an integral high-pass filter in an entirely new approach to the problem of coupling carrier equipment to power lines. This unit, with a flat pass characteristic above 50 k.c., per-

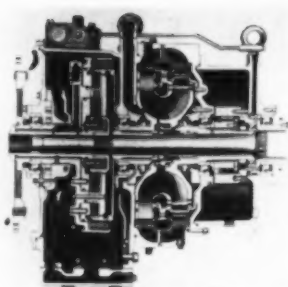


Motorola Aperiodic Power Line Coupling Unit of Voltage Class 69KV

mits broad-band coupling. Any number of receivers may be coupled through one Aperiodic unit, as can any number of transmitters with up to 25 watts total output power. In addition, multiple frequency by-pass at switching points is readily accomplished utilizing only two Aperiodic units. Basically, a coupling unit is intended to transfer the high frequency carrier (50-200 k.c.) onto the power line with a minimum of attenuation. Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.

Hydraulic Torque Converter

Development of a three-stage hydraulic torque converter transmission for off-highway trucking application, stated to eliminate 99% of the forward gear shifting and, with engine drag, to be able to perform 90% of the down-hill braking, has been announced by the Twin Disc Clutch Co., Racine, Wis. The new unit is known as the Twin Disc Model DF direct drive hydraulic torque converter. It is actually a compound unit made up of three major assembly groups: (a) the oil actuated clutch group, (b) the basic torque converter and (c) the free-wheel assembly. Hydraulic braking is provided in a very smooth and effortless manner merely by moving the control valve to the braking position. This is normally

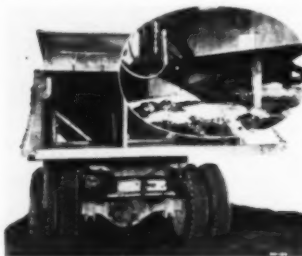


Model DF Twin Disc Hydraulic Torque Converter

done when the converter is operating in direct drive. In this position, the control valve spool uncovers both the direct mechanical drive clutch ports and the hydraulic drive clutch ports, thus driving the converter, direct drive shaft, and engine at a common speed resulting in maximum braking effort. Parts of this braking effort is in the form of engine drag; however, the braking effort is substantially increased due to absorption of the braking load by the torque converter system. Thus, total braking is made up of the resistance offered by engine drag and energy absorbed by the converter impeller.

Air Vibrator on Trucks

One of the larger metropolitan cities in Minnesota is now using a Cleveland air vibrator, known as the Type F, to speed



Air Vibrator on Truck Speeds Flow of Sand

the flow of sand, cinders and salt on icy roads. As shown in the accompanying illustration, the Type F is easily mounted on the tapered side of a hopper-equipped truck. It keeps the material moving steadily at low cost. The type F is made by Cleveland Vibrator Co., 2886 Clinton Ave., Cleveland, O.

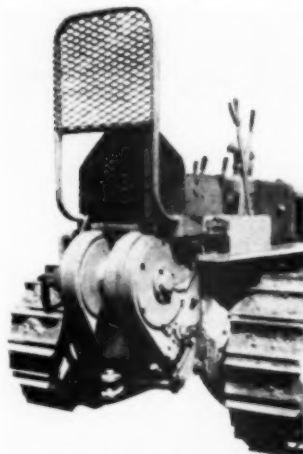
Sealing Off Leaks

A new stabilizing ingredient has been added to Flextite that speeds up action in sealing off leaks, and water seepage in concrete walls, the manufacturer reports. The new Flextite is stated to provide quicker action and more thorough bonding, hence increased protection. A liquid chemical to be mixed with cement or cement and sand, Flextite produces a mortar that is easily handled, fast-setting. Forced into an opening—even against hydrostatic pressure—it is said to seal off severe, fast-flowing leaks in tunnels, dams, engine rooms, elevator pits, and tanks in a matter of minutes. Material is also recommended for plas-

ter-coating walls above or below ground or water level, for pointing up spalled areas, for converting wet, damp factory basements into dry, useful space. Flexrock Co., Filbert and Cuthbert, W. of 36th St., Philadelphia 4, Pa.

Tractor Winch

Designed to supply increasing demand for a lightweight, free-spooling tractor winch with fast line speeds and quick positive brake action a completely new H4



D4 HySpeed Winch

HySpeed winch has been developed by the Hyster Co. The new winch can be mounted on either seat or fender tank type "Caterpillar" D4 Tractors. The winch has cable capacities of 335 ft. for 1/2 in. line, and 214 ft. for 3/4 in. line. The line pull: Bare drum, 7000 lb.; full drum, 3100 lb. Line speeds: Bare drum, 225 f.p.m.; full drum, 515 f.p.m. Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.

High Precision Transit

A new transit designed for high precision surveying has been announced by



Breithaupt Model No. 30 Transit

Here's photo proof that DURAPLASTIC* minimizes bleeding and segregation



● This picture of finishers working so closely behind the paver is clear evidence that Atlas Duraplastic air-entraining portland cement minimizes bleeding and segregation in concrete paving mixes.

Experience proves, too, such concrete is fortified against freezing-thawing weather and

the scaling action of de-icing salts.

Duraplastic-made concrete requires less mixing water for a given slump. The mix is more plastic, more cohesive and more uniform. It dumps, spreads and finishes easily...allows earlier protection for curing.

YET DURAPLASTIC COSTS NO MORE

OFFICES: Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.

It sells at the same price as regular cement and requires no unusual changes in procedure. Complies with ASTM and Federal Specifications. For descriptive booklet, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, New York.

*"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.

NS-D-139

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DURAPLASTIC

AIR-ENTRAINING PORTLAND CEMENT

Makes Better Concrete at No Extra Cost



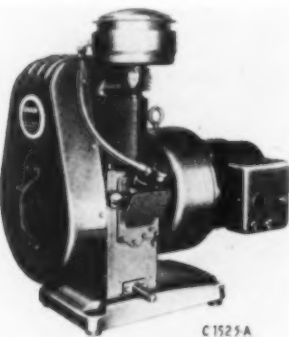
"THE THEATRE GUILD ON THE AIR"—Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network

When writing advertisers please mention ROADS AND STREETS, November, 1951

The Breithaupt Co., Western Germany. The new model incorporates the standard features of Breithaupt surveying instruments such as totally enclosed and dust proof construction, compactness and reduced weight. The illustrated instrument weighs 11½ lb. It has a reading accuracy on vertical and horizontal circles of one second. The telescope has 40 mm. aperture and 30 x magnification. The sensitivity of the instrument's three levels is 20 seconds per 2 mm. The new transit is available through the manufacturer's exclusive representatives: Columbia Technical Corporation, 5 East 55th St., New York 22, N. Y.

Diesel Electric Plant

A new 3,000-watt diesel electric plant, powered by an air-cooled full-diesel Onan engine, has been announced by D. W. Onan & Sons, Inc. Simplified plant design is stated to make it possible for anyone to operate and service this Model 3DSP-1E diesel unit. Push-switch control for electric cranking, manual compression release, and an electrically heated glow-plug for cold weather starting are provided. The plant is driven by an



C1525A

Onan Model 3DSP-1E Diesel Unit

improved 4-cycle single-cylinder Onan DSP diesel engine which incorporates many new engineering features that have increased power output and operating efficiency. Exceptional operating economy is claimed, approximately 0.155 gal. of low-cost furnace oil per kilowatt hour at full rated load. The Model 3DSP-1E generates 115-volt, 60-cycle, single-phase current. Other A.C. models available in single-phase produce 230 volts and 115/230 volts. A 32-volt battery charging model can also be supplied. All models are conservatively rated to provide ample overload protection. D. W. Onan & Sons, Inc., Minneapolis 14, Minn.

Lightweight Air Drills

A new series of small lightweight portable air drills has been announced by Ingersoll-Rand. Outstanding features claimed for the drills include: One-piece housing provides a compact, well balanced, exceptionally short, and lightweight drill. A more powerful redesigned five-vane air motor, to provide a constantly smooth flow of power. Built in automatic lubricator. An advancement in throttle valve design eliminates air leakage. A specially designed muffler minimizes exhaust noise, and an adjustable exhaust deflector permits the operator to direct exhaust air in any direction.

Known as the OA and OB Multi-Vane drills, the tools are available in several different speeds for work up to ¼ in. capacity. The units weigh from 2½ to 3½ lbs. Ingersoll-Rand Co., Dept. PT, 11 Broadway, New York, N. Y.

Concrete Cutting Machine

A new DeMet standard model concrete cutter, announced by Felker Manufacturing Co., has been developed to sell at a considerably lower cost than the heavy-duty DeMet machine, and yet handle practically all ordinary concrete cutting requirements. The new model uses a 12 in. maximum Di-Met diamond wheel size on either the right or left end of the spindle, cutting to a 3½ in. depth. Spindle is mounted in ball bearings. The diamond wheel can be lowered readily to



Di-Met Standard Model Concrete Cutter

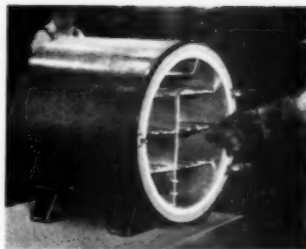
proper cutting depth by means of a manually operated worm and gear, or when cutting is not required, the worm gear lifts the diamond wheel completely clear of the work. Two Coolant provisions have been made. A 15 gal. tank supplies water to the blade when other sources are unavailable. Pressurized water may be supplied from mains or tank trucks through a hose to an independent water connection. Valves are provided which shut off the 15 gal. tank supply when water is furnished through a hose. Jets force the water stream against blade sides to insure proper cleansing and cooling. Balance of the complete unit is such that it can be readily pivoted on the rear wheels, turning in its own length. The Di-Met standard model is powered with a 7.5 h.p. Wisconsin air-cooled gasoline engine which is almost instantly removable. Felker Manufacturing Co., Torrance, Calif.

High-Chair Controls

New controls for the "Cat" D4 tractor of the Caterpillar Tractor Co., Peoria, Ill., equipped with HT4 Traxcavator now match the higher seat that gives a better view of dig, lift, carry, dump, and 'doze operations. The revised design allows greater length without interference, for gearshift, flywheel clutch, and steering clutch levers. Operator fatigue is reduced.

Electrode Oven

A new electrode oven, announced by Philip Roden Co., is claimed to give full protection against moisture absorption



DryRod Electrode Unit

by mineral-coated electrodes. It is claimed the oven fills the gap between unpackaging of the manufacturer's sealed containers and actual use of the electrodes in the welding line. The oven is a portable heated storage unit which provides control over the moisture content and temperature of electrodes at their point of use, and makes possible a system of orderly electrode control whereby assurance of better quality welds may be had. According to the manufacturer, the oven will accurately control the moisture to within 2%, the normal accepted U. S. Government standard for moisture content. The oven is basically a cylindrical, compartmented sheet metal unit which is heated by an 840 watt element operating off 110 or 220 volt circuits. Philip Roden Co., 721 East Lake Bluff Blvd., Milwaukee 11, Wis.

Liner for Irrigation Canals

A new product, irrigation canal liner, designed to control seepage and erosion in ditches and canals, announced by Owens-Corning Fiberglas Corporation, is a Fiberglas-reinforced prefabricated asphaltic membrane lining for installation on bottoms and sides of most types of canals and lateral ditches. The liner was developed by Owens-Corning in cooperation with the U. S. Bureau of Reclamation. Fiberglas canal liner can be applied at any time during the year and can be stored indefinitely. It can be installed with hand tools and unskilled labor. Two men can install it, and a crew of four to six men can apply from 200 to 300 sq. yds. an hour under normal conditions. In the first step in construction, the canal or ditch is over-excavated to a depth of 1 ft. If conditions are severe and greater cover depth is required, the depth may be 2 ft. Excavation to a sufficient depth is necessary to allow earth or gravel fill to be placed over the liner. The liner comes in sections 3 ft. wide and 36 ft.



Longitudinal Installation of Fiberglas Irrigation Canal Liner



STONE AND
WOOD GRABS
CLAMSHELL
DREDGE
CUSTOM-BUILT
BUCKETS

WELLMAN

EASY HANDLING OF LARGE STONES

● Those big stones won't slip from the Wellman Stone Grab. Four-part closing cable reeving develops tremendous closing force on stones. Model shown has 5-ton capacity, 4½ foot jaw spread. Other capacities available.

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HELPING AMERICA GET THINGS DONE

Once again the Armed Forces are demanding FRINK SNO-PLOWS for snow removal where speed and reliability are an absolute necessity.

The specifications are strict and the FRINK easily qualifies because of sturdy construction. Its many exclusive features have been tested under all snow conditions, in major snow areas, and the 18 plows that make up the FRINK line provide faster and more economical snow removal.

Write for information regarding the FRINK features. FRINK PLOWS are available for trucks with capacities from 1½ to 12 tons.

For Further Information
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Clayton, N.Y.



FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK
DAVENPORT-BESLER CORP., DAVENPORT, IOWA
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On the Elk River Bridge Project, Garrett & Farris Company of Knoxville, Tennessee, uses its MICHIGAN to pour concrete... strip forms... charge the batcher... excavate for pier foundations... load materials at a rail siding four miles distant and unload back at the job... sort pilings and supply the pile driver... position the pile puller when needed... all in a day's routine.

And look at some of the savings:



ONLY 3 MEN NEEDED ON BATCHING AND POURING.

A HALF-HOUR JOB THAT FORMERLY TOOK HALF A DAY... here the MICHIGAN reduces labor costs 80%.



75% MAN-POWER SAVINGS BY HANDLING STRIPPED FORMS with the MICHIGAN.

When it's versatility and savings you want... investigate MICHIGAN... you'll agree it's your best buy!

MICHIGAN POWER SHOVEL COMPANY

480 Second Street, Benton Harbor, Michigan, U. S. A.

long and can be installed longitudinally or transversely. Rapid-setting cut back asphalt is used to seal joints of the strips which are overlapped by at least 3 in. Wire staples, up to 8 in. for soft ground, may be used to anchor the lining to the ground at intervals of 2 ft. in the overlap. This operation prevents the liner from slipping before the backfill is in place. Excavated soil then is placed over the liner. If the canal is subject to erosion, a gravel blanket, 4 in. to 1 ft. deep, may be placed over the soil. Owens-Corning Fiberglas Corporation, Toledo 1, O.

Steam Cleaning Unit

A new heavy-duty Cleaning unit, called the Power Master, announced by Kelite Products, Inc., has two high-pressure steam guns. In addition to the unusually large steam cleaning capacity, the unit incorporates a high-pressure water gun



Power Master Cleaning Unit, Steam Nozzles at left; Water Gun at Right

supplying hot or cold water at a pressure of 500 lb. per square inch. The power blast feature of the unit delivers 1,000 gal. of water per hour for blasting away accumulations of mud, muck, heavy grease, etc. Kelite Products, Inc., 1250 North Main St., Los Angeles 12, Calif.

Quick Stabilization of Steel

Complete dimensional stabilization of steel, ordinarily requiring years of seasoning, is now being effected in a matter of hours by chilling to -120 F. in Sub-Zero industrial chilling machines, according to Sub-Zero Products Division, Deepfreeze Distributing Corporation. In ordinary heating and quenching of steel not all the austenite is transformed to martensite. This unchanged portion causes dimensional growth and warp over a period of time. However, it has been found that repeated cycles of heating to room temperature and chilling to 120 degrees below zero F. brings about 100% transformation of austenite to martensite. As a result of this change complete stabilization is obtained. At the same time greater hardness, strength and ductility is obtained according to the manufacturer's reports. This application of Sub-Zero chilling is stated to have been found effective on any steel part where dimensional stability is important. Sub-Zero Products Manufacturing Division, Deepfreeze Distributing Corp., Cincinnati 29, O.

Welding Fittings and Joint

Welding fittings and joint for corrosion resistant coated piping have been announced by Welstrom. The fittings and joints are available in all standard sizes and types of welding fittings and joints from 1/2 in. up to 30 in. in diameter. Turbulence, a prime cause of failure in many types of corrosion resistant piping, is stated to be eliminated because Welstrom fittings have an internal diameter identical with the pipe.

Welstrom fittings and piping systems are coated or lined with corrosion resistant coatings in the manufacturer's plant. Any alterations which are necessary for field assembly, resulting from slight changes in design layouts, can readily be made in the field. Welstrom, Fifth St. and North Ford Blvd., Hamilton, O.

Torque Converter Drive Locomotives

A new series of diesel powered Davenport industrial locomotives with torque converter drive has been announced. These locomotives are obtainable in a range of sizes and gauges to meet the requirements of individual operating



20-Ton, 24 in. Gauge Locomotive

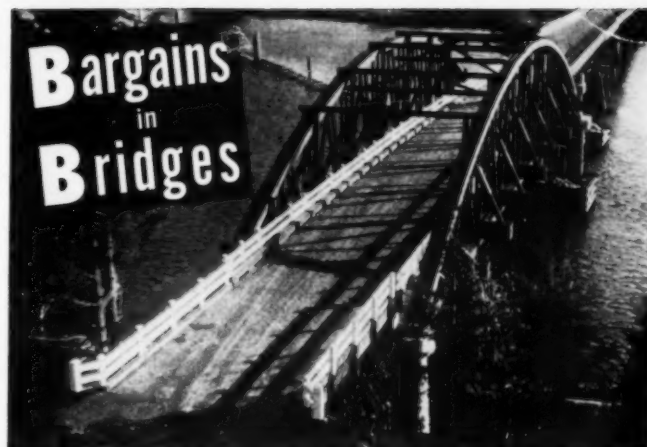
conditions. They may also be gasoline engine equipped. The locomotive illustrated is of 20-ton, 24 in. gauge and it is equipped with a No. 6080 General Motors diesel engine and an Allison torque converter. Davenport Locomotive Division, Davenport Besler Corporation, 2305 Rockingham Road, Davenport, Ia.

Air Entraining Agent

A new product for entraining air in concrete, announced by Davies-Young Soap Co., is called "Buckeye" Vinsol Resin Solution. Containing 12½% vinsol resin, the new solution is stated to provide greater workability with less water for a given slump. Concrete mixed with the solution is claimed to flow into forms more freely and to require less spading, roding, and vibration. Where interground air entrained cement is used in an average concrete (5 to 5½ sacks per yard) the use of approximately ½ ounce of the solution per bag of cement is stated to generally produce the entrainment of 3-6% of air. Where gray cement is used, it is suggested that 2 to 2½ ounces of the solution be used per bag of cement. Davies-Young Soap Co., Dayton, O.

Mobile Radio Equipment

New 25-50 m.c. mobile radio communications equipment for operation in both 20 k.c. and 40 k.c. channel widths, and featuring quadra-tuned I.F. transformers in the receivers, has been announced by the General Electric Co. Separate models are available for operation in either 20 or 40 k.c. channels, and the wide band equipment can later be converted to 20 k.c. operation at extremely low cost—only three standard condensers and three standard resistors. Five high Q tuned circuits between the antenna and first converter improve reception and reduce interference. Using the 20 d.b. quieting method, the receiver for 20 k.c. operation has selectivity of 100 d.b. down at plus or minus 20 k.c. By the same method, the 40 k.c. receiver has selectivity of 100 d.b. down at plus or minus 30 k.c. Dept. N-7, Inquiry Section, G-E Advertising Division, Electronics Park, Syracuse, N. Y.



566-foot bridge across Smith River in Douglas County, Oregon. Truss section fabricated by Timber Structures, Inc.

Permanent bridges needed to keep essential traffic moving are readily available in spite of certain material shortages. These are of engineered timber construction, fabricated by Timber Structures, Inc.

The bridge shown here is typical of this construction. It is an actual demonstration of how to build permanent, serviceable, trouble-free bridges on limited budgets. Here are the details of this job:

Bridge is 566 feet long overall, with truss section of 183 feet, and portal clearance of 15 feet. Clear width of roadway is 20 feet, with wearing surface of asphalt bituminous, supported by 2x10 laminations. H-20 loading. Truss chords are glued laminated Douglas fir members, preservative treated and joined to other

bridge members with split ring connectors. Total cost of the bridge, including concrete piers, was approximately \$150,000.

Five Basic Types of Engineered Timber Bridges

The bowstring truss bridge is only one of five basic types. Others are deck arch, girder, composite deck and parallel chord truss. All five types may be given any desired preservative treatment to protect them against attack by decay or termites.

These bridges are described and illustrated in a new brochure, "Permanent Timber Bridges". Your nearest Timber Structures representative has a copy for you; or you may obtain one by filling out and mailing the coupon below.

TIMBER STRUCTURES, INC.

P. O. BOX 3782-W, PORTLAND 8, OREGON

Offices in New York, Chicago, Kansas City, Missouri, Dallas, Texas; Eugene, Oregon; Seattle and Spokane, Washington
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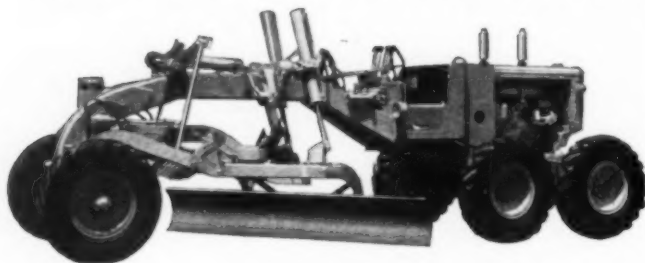
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YOU ONLY GET YOUR MONEY'S WORTH
WHEN THE *Blade* WORKS RIGHT

WARCO is the **ONLY** motor grader whose blade...entirely cab-controlled...attains all working positions. Other graders rely on manual adjustment to reach many positions. That's how **WARCO** cuts "dead-heading"...reduces manual adjustment down-time...increases profits.



Let your **WARCO** dealer demonstrate **NOW....**

WARCO 4D-100 Motor Grader
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MOTOR GRADERS

W. A. RIDDELL CORP.
AUSTIN, CHIO

builders of WARCO Motor Graders - HERCULES Road Rollers

**WITH THE
MANUFACTURERS
& DISTRIBUTORS**

Shakespeare Appointed Sales Manager. William V. Shakespeare has been appointed sales manager of the Thor export sales division of Independent Pneumatic Tool Co., Aurora, Ill. Mr. Shakespeare, whose headquarters will be in the Thor export offices at 330 West 42nd St., New York, N. Y., has been a field engineer in the division for the past 15 years.

Davey Promotes Howard. R. E. Howard, for the past six years manager of internal orders and invoicing department of Davey Compressor Co., Kent, O., has been appointed comptroller and assistant treasurer.

Tuthill Opens New Plant. Tuthill Spring Co., Chicago, Ill., manufacturers of leaf springs for over 70 years, has opened a new plant in Mokena, Ill. The new building, first of several to be erected, is a modern 60 ft. x 330 ft. structure of fire-proof brick construction with aluminum roof. Tuthill operations in Mokena include the manufacture of agricultural



New Tuthill Plant in Mokena, Ill.

implement parts such as spring harrow teeth, cultivator shovels, stalk cutter and lawn mower blades. The main plant in Chicago will continue in full operation manufacturing Tuthill alloy steel leaf springs. The company also manufactures the Tuthill highway guard. Office headquarters are: Tuthill Spring Co., 760 Polk St., Chicago 7, Ill.

Termite Sales Appointment. Termite Drills, Inc., Pasadena, Calif., has appointed Clark & Sawyer, Inc., Los Angeles, Calif. as sales representatives for all states west of the Mississippi River, and the Specialty Co., Inc., Lakeville, Conn., as representatives for Termite drills in all territory east of the Mississippi. Export sales are handled by John H. MacIntyre, El Monte, Calif.

Laramy Promoted by Worthington. J. B. Laramy, for the past six years assistant Manager of the Chicago district office, has been appointed manager of the Marketing Research Department of the Worthington Pump and Machinery Corporation, Harrison, N. J.

Appointed Executive Engineer. H. V. Rasmussen has been appointed executive engineer at the Wellsville, N. Y. plant of Worthington Pump and Machinery Corporation, Harrison, N. J. Well known in the steam turbine engineering field, Mr. Rasmussen has spent a number of years with both the Westinghouse Electric Corporation and the DeLaval Steam Turbine Company.

MANUFACTURERS' LITERATURE

Fluid-Driven Road Broom

A bulletin, AD-40, is available on the Lull fluid-driven broom sweeper. The sweeper is driven by a Lull precision-built hydraulic pump off the tractor engine crankshaft. Raising and lowering the broom is power hydraulically controlled from the operator's seat. Sweeping angle adjustment to a maximum of 35 degrees, right or left, is also power hydraulically controlled from the operator's location. Three sizes of the sweeper are available in broom lengths of 5 ft., 6 ft. and 7 ft. Lull Manufacturing Co., 3612 East 44th St., Minneapolis 6, Minn.

Expanded Metal Catalog

A new catalog issued by Penn Metal Co., Inc., tells in considerable detail the story of the manufacture of expanded metal and its uses. The catalog shows a great many examples of uses for this product and suggests many others. Penn Metal Co., Inc., General Sales Offices, 205 East 42nd St., New York 17, N. Y.

Motor Scraper

A new 16-page catalog, No. A-1285, describing the Model TS 300 motor scraper, a high speed, rubber-tired, self-propelled earthmover, has been released by La-Plant-Choate Manufacturing Co., Inc. The text and illustrations explain the construction features of the motor scraper in full detail. Individual illustrations of the various component parts are included. The center spread is devoted to a large model shot of the scraper and complete machine specifications. La-Plant-Choate Manufacturing Co., Inc., Cedar Rapids, Ia.

Joint Cleaning Machine

The specialized functions The Tennant Model G concrete grooving and joint cleaning machine performs in connection with highway, airport and construction work are reviewed in a new bulletin. The Model G cleans all types of pavement joints as well as irregular fissures to prepare them for resealing. The machine makes a clean, deep cut, thoroughly removing all old bituminous material and simultaneously roughening the sidewalls of the crack or joint to insure a good bond with the new seal. It can be adapted for cracks and joints of all widths up to 4 1/4 in. Besides joint cleaning, the Model G will do a number of other jobs. It will, for instance, remove extruded material and reduce humps on concrete or asphalt pavements. It will cut paint lines from concrete or asphalt without injuring the surface. It will remove a lip to prepare a pavement for widening or resurfacing. G. H. Tennant Co., 2530 N. Second St., Minneapolis 11, Minn.

Rubber Tired Trencher

A 4-page circular issued by Mobile Trencher Co., illustrates and describes its trenchers. This Machine is mounted on a Minneapolis Moline industrial tractor equipped with 1400 x 24 tires. The trencher has an overall length of 18 ft. and weighs 9,200 lb. The trencher boom height is 8 ft. 6 in. The maximum trench-

Gorman-Rupp's Handle Low Water Crisis at Rye Lake



When Rye Lake, Westchester County, New York, receded, cutting off three villages from water supply, the crisis was met by putting dependable Gorman-Rupp pumps on the job.

240-M
10 inch



THE WORLD'S MOST COMPLETE LINE ... OF SELF-PRIMING CENTRIFUGAL PUMPS

Whatever the job requires: a tiny twenty pound "Handy" pump, a lightweight "Midget" pumping 5500 GPH. or a pump handling up to 240,000 GPH. you will find the most efficient pump is the Gorman-Rupp.

QUICKEST PRIMING: The 40 M, for example, primes at 15 foot Suction Lift in 40 seconds.

HIGHEST PRIMING: High suction lifts are easy for Gorman-Rupp Pumps.

FASTEST PUMPING: More water per gallon of fuel than any other comparable pump.

DEPENDABLE: The most simple pump built — will not clog. Trouble-free, requiring a minimum of maintenance.

GUARANTEED IN PLAIN LANGUAGE by Manufacturer and Distributor. Ask for copy of our guarantee.

Write for new Contractors' Bulletin 8-CP-11.



ing depth is 60 in. and the trench width 13 in. to 15½ in. Mobile Trencher Co., 140 West Maple St., Monrovia, Calif.

Welding Accessories

A new 16-page, 8½ x 11 arc welding accessories catalog (EW-164-5), announced by Hobart Brothers Co., Troy, O., contains the complete line of Hobart arc welding accessories and supplies.

Water Repellent for Masonry Walls

A new technical treatise on the use of silicone base materials to make masonry walls water repellent has been announced by The Monro Co., Inc. The bulletin contains a study of the water repellency problem. It discusses preventive methods

and emphasizes the newly developed use of silicones for this purpose. Test data is presented. The Monro Co., Inc., 10703 Quebec Ave., Cleveland 6, O.

Corrosion Protection

A new bulletin, describing "Low Cost Corrosion Protection" has been published by Permolite, Inc. The six-page folder explains Permolite pigmented organic corrosion resistant coatings, their application by brush, spray or dip... air-dried or baked. Pictures of various products and equipment protected with Permolite are shown, together with a list of typical applications. Illustrations and a description of the manufacturer's custom-coating plant are included. The coatings may also be applied in users' plants. Permolite, Inc., Hamilton, O.

Concrete Machinery

The Willard way of handling concrete is shown by job pictures in a 12-page circular. Nineteen illustrations picture the use of Willard mobile equipment. Principles of "The Willard Way" are first, the loading and weighing of aggregates from stockpiles and the weighing of cement from storage by the self-loading weigh batcher; second, the charging of the mixer by the portable mixer loading conveyor, and finally, the mixing, transporting, and placing of the concrete by the transit truck mixer. These three machines are built by Willard Concrete Machinery Co., Lynwood, Calif.

Mobile Aggregate Dryer

The Tarco "Flash Flame" aggregate dryer is illustrated and described in a 4-page circular. The dryer consists of four main units: power source, drying drum, heat source and chassis. It weighs 664 lb. and is mounted on pneumatic-tired roller-bearing wheels. The approximate dimensions are: Overall length, 10 ft. 2 in.; overall height, 4 ft. 3 in.; overall width, 3 ft. 2 in.; loading height, 32 in. An attachment is available for reheating stockpiled bituminous plant mix. Tarrant Manufacturing Co., Saratoga Spring, N. Y.

Laykold Fibrecoat

A new 4-page brochure giving detailed application data and listing outstanding uses of Laykold Fibrecoat, a weather-proof mineral-armored asphalt, has been issued by American Bitumuls & Asphalt Co. The folder outlines the intelligent utilization of Laykold Fibrecoat, for protection of bituminous roofs and metal. It includes specifications, application data, approximate costs, and illustrated, detailed information regarding equipment used in applying the product. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif.

Welders

Four circulars are available on Miller welding equipment. Descriptions and illustrations are given for an engine-driven AC arc welder and power plant; for an air-operated spot welder; for a manually-operated spot welder; and for two models of portable spot welders. Specifications for the various welders are included. Miller Electric Manufacturing Co., Appleton, Wis.

Makes Truck Self Loading

Equipment that makes a truck self-loading and also enables it to do light digging, scooping, grading and removing loose materials is described in a catalog issued by Ernest Holmes Co. The equipment, the Holmes-Owen Self-Loader, is mounted on the truck and has independent hydraulic cylinders, operated by a pump driven from a conventional power take-off, through a propeller shaft which may also be used to power a separate drive for dump-body operations. Various operations of this loader are illustrated and described, and specifications are given. Ernest Holmes Co., Chattanooga, Tenn.

Land Clearing Equipment

Fleco heavy-duty land clearing equipment for use with track-type tractors is described in an 8-page catalog of Florida Land Clearing Equipment Co. Illustrated and described are a stump, a root rake

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THE SYMBOL OF A QUALITY

SNOW PLOW



*The Leaders
For Over a
Quarter of
a Century*

A STYLE & SIZE FOR EVERY REQUIREMENT

MOLDBOARD

ALLOY STEEL for strength.
ROLLED SMOOTH for less resistance.
ADJUSTABLE for pitch.
SPRING MOUNTED deflectors.
ADJUSTABLE and oscillating shoes.

HITCH

LEVEL Lift.
TAILORED to truck to distribute weight and stress.
4 OR 6 POINT push using Wausau's exclusive toggle.
CHAFING for side thrust.



VEE TYPE REVERSIBLE TRIP BLADES AND HIGH SPEED ONE-WAY BLADES ARE AVAILABLE FOR ALL TRUCKS, GRADERS AND WHEEL TRACTORS.

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Positive control of Thickness
Positive control of Width
Positive control of Direction
No hazards to passing vehicles
Low Cost self contained unit
A differential drives the hopper agitator and spinner disc which prevents skidding and consequent loss of



spinning power while turning corners.
Attached or disconnected in a minute
Model A Operator platform
"Safety Built"
Long life construction --
Sturdily built
Spreads Materials from 5 to 20 Feet

Write for details

WAUSAU IRON WORKS

PIONEER SNOW PLOW BUILDERS
WAUSAU, WISCONSIN

Sold and Serviced By Leading Equipment Distributors

and a rock rake. How this equipment is used and the results obtained from its use are described. Many illustrations of difficult land clearing operations with this equipment are shown in the catalog. Florida Land Clearing Equipment Co., Jacksonville, Fla.

Concrete Sawing Equipment

Its complete line of concrete sawing equipment is featured in a 4-page catalog of Concrete Sawing Equipment, Inc. Illustrations, descriptions and specifications are included for the Model 51, self-propelled Concut concrete saw, the standard Concut saw, the clean-cut saw and the Concut trailer. The Concut blades also are described. Concrete Sawing Equipment, Inc., 200 Union National Bank Bldg., Pasadena 1, Calif.

Membrane Liner for Irrigation Canals

Fiberglass liner, a new product for controlling seepage and erosion in ditches and canals, is described in an 8-page circular issued by Owens-Corning Fiberglass Corporation. The liner is a tough, flexible, prefabricated membrane consisting of durable, waterproof asphaltic compounds reinforced with fibrous glass mat and strong Fiberglass yarns. The liner is supplied in rolls, 36 in. wide and 36 ft. long. The circular tells how this liner is applied and illustrations are given of the methods of application. Owens-Corning Fiberglass Corporation, Toledo 1, O.

Sludge Pumps

The Ralph B. Carter Co. has released the latest in their series of technical bulletins on sanitation engineering equipment—for the municipal sewage and industrial waste fields. Bulletin No. 5102, on Carter plunger sludge pumps, replaces and revises bulletins 4502 and 5002. The 16 pages include detailed information, engineering data and specifications on their complete series of plunger sludge pumps. Pump and motor selection charts, plus specifications and lubrication data—along with essential data on diaphragm pumps for general duty—are included. Mr. J. Williamson, Ralph B. Carter Co., 224 Atlantic St., Hackensack, N. J.

Compression Pipe Coupling

A new style compression pipe coupling to practically eliminate turbulence at the pipe joint and to materially reduce corrosion is described in detail in a 4-page technical bulletin of Morris Coupling & Clamp Co., P. O. Box 632, Ellwood City, Pa. Described also are Morris pipe repair clamps designed for fast, emergency service.

Motor Grader Operation

A new motor grader operator's handbook in 4-color cartoon style has been published by Caterpillar Tractor Co. As voiced by an experienced operator who serves as instructor, "Motor Graders lend themselves to skillful operation, and the good operator's ability will be quickly recognized." Thus the 12-page handbook offers adjustments and techniques that apply to jobs ranging from high bank cuts to flat bottom ditching. Caterpillar Tractor Co., Peoria 8, Ill.

Air Entrained Concrete

A new foaming and dispersing agent (Foamsol) for air entrained concrete is

A Jaeger never races to prime



Pump longer because they pull stronger, at easy speeds

Dewatering 1500' of 8' x 14' deep sewer trench at a river crossing, this 4" Jaeger pump handled 40,000 gph at average speed of only 1200 rpm (10% to 15% lower speed than other pumps), and primed quickly, as needed, at 1400 rpm (compared with 1800 to 2000 rpm required to prime ordinary pumps). This is typical performance. Jaeger's larger shells and impellers, double priming action and use of largest engines applicable mean high efficiency, fuel economy, long life—in 1½" to 10" pumps.

See your Jaeger distributor or send for Catalog P-10

THE JAEGER MACHINE COMPANY

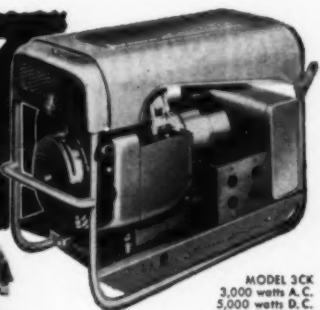
223, Dublin Avenue,
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COMPRESSORS • MIXERS • HOISTS • TOWERS • PAVING MACHINERY

Cut Costs!
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*Take 'em
Anywhere!*



MODEL 3CX
3,000 watts A.C.
5,000 watts D.C.
with carrying frame
or dolly-mounted

Increase your profits by using fast-working, cost-cutting electric tools on every job, even where highline power is not available. Lightweight, sturdy, Onan engine-driven electric plants supply instantly-available power anywhere for lights, drills, saws, pipe-

threaders, planers, spades, tampers, repair-shop tools and other motor-driven equipment. Carry 'em, wheel 'em, or truck 'em right to the spot and plug in for all the power you need. Equipped with carrying handles or dolly-mounted.

Lightweight Air-Cooled Models: A.C.—400 to 3,000 watts. D.C.—750 to 5,000 watts. Heavy-duty models to 35,000 watts.



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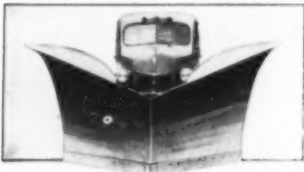
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One-way plow—crimped blade means much better aeration—sturdy, balanced design.



V-Plow—extra heavy construction, interchangeability, direct lift. (Choice of 22 models.)

An old name in snow removal equipment is ready to go to work for you.

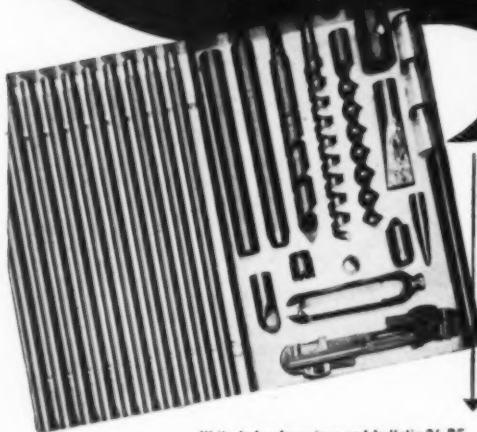
Forward looking city, township, county and state highway officials are already planning to meet this winter's snow removal problems.

There's a reason why Gledhill Highway Equipment is known far and wide! It cost less at the start—soon pays for itself.

Look for the blue Gledhills: Drawn graders, maintainers, scrapers, earth movers, snow plows, and self powered traffic line markers.

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gives you
accurate
sub-surface
information
Quickly—
Easily—
Inexpensively

Write today for prices and bulletin 26-RS

ACKER DRILL CO., INC., SCRANTON 3, PA.

Over 30 years of experience in the manufacture and development of drilling equipment

described in a 6-page circular of Onyx Oil & Chemical Co. Foamasil is a mixture of stable chemical ingredients. It contains a sodium salt of an alkyl-naphthalene sulfonic acid, which is stated to provide its excellent foaming and dispersing action. The protein-type content is claimed to be very effective in reducing segregation, improving workability and promoting the formation of smooth finished surfaces. Field and laboratory tests are given in the circular. Onyx Oil & Chemical Co., Industrial Division, 190 Warren St., Jersey City 2, N. J.

Mobile Patching Unit

The new Hetherington & Berner mobile patching unit, the Moto-Patcher, designed especially for use in road and street maintenance, is illustrated and described in a 2-page bulletin. A flow diagram for the unit and specifications are included. The Moto-Patcher delivers up to 10 tons of freshly mixed material per hour. Hetherington & Berner, Inc., 701-45 Kentucky Ave., Indianapolis 7, Ind.

Concrete Testing Machine

Baldwin concrete testing machines of 100,000 lb. capacity are presented in a new 2-page bulletin, No. 327. The bulletin covers features, including hydraulic loading, independent hydraulic load weighing, accessories, and specifications. Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

Lathes, Drill Presses, Shapers

Two new catalogs by South Bend Lathe illustrate and describe practically their entire line of precision lathes, drill presses, shapers, attachments and accessories. Only 2½ in. x 1½ in., each of these little accordion folded jobs contains 28 pages with clear cut illustrations and highly legible (though small) type matter describing all important products of the company. South Bend Lathe, South Bend 22, Ind.

Rubber Powder in Asphalt Roads

Descriptions of four recent test roads in Great Britain on which natural rubber powder was incorporated in the surfacings are given in a 30-page bulletin of The British Rubber Development Board. One chapter is devoted to the method of operation and application of the rubber powder. Copies of the bulletin are available from the Natural Rubber Bureau, 1631 K St. N. W., Washington 6, D. C.

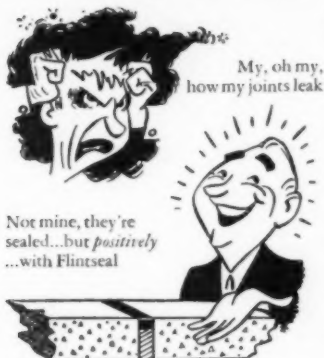
Aerial Surveys

A new booklet, "Aerial Surveys and Maps from Photographs," issued by Abrams Aerial Survey Corp., is a complete explanation of aerial surveying. In it the photogrammetric process is diagrammed. The planes and cameras used in aerial photography and the instruments used in the laboratory processing are illustrated. The various maps and photographs available from aerial surveys are illustrated and explained along with the uses that can be made of each type. Abrams Aerial Survey Corporation, 606 E. Shawnee St., Lansing 1, Mich.

Spray Painting

"Sprayways," a graphic 16-page rotogravure brochure, issued by the Devilbiss Co., is a ready reference to many Devilbiss spray equipment uses. Nearly 100 photographs have been incorporated in the publication to graphically display the many spray equipment uses. The

Stop worrying about joints...



... specify *Flintseal* Hot-poured joint-sealing Compound

(Fed. Spec. SS-F-336a)

Troubles you may have had with sealers that flow or extrude, crack or pull away, simply do not exist when the joints are sealed with Flintseal.

One application lasts for years... gives positive sealing against water and foreign matter. Flintseal holds its bond firmly through extremes of hot and cold weather.

Flintseal is a rubber asphalt thermoplastic compound of the hot-poured type that remains extensible and compressible through complete cycles of expansion and contraction of the concrete.

Thousands of miles of concrete highways, streets and airport strips need positive sealing of joints to protect the millions of dollars invested. Flintseal has been field-proved for this purpose.

Send for free, illustrated, descriptive booklet

Complete technical data and specification procedures are also available upon request.

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FLINTKOTE

Products for Industry

*Reg. U. S. Pat. Off.

photographs are actual scenes where spray painting equipment is being used. Spray Painting Equipment Division, Devilbiss Co., Toledo 1, O.

Calcium Chloride

A booklet containing a selected list of current technical publications, available from the Calcium Chloride Association, has been issued by the Association. These publications are designed to provide standard procedures and approved techniques for handling calcium chloride in many of its various uses. The list includes bulletins and briefs on the use of calcium chloride in surface consolidation and maintenance; in stabilized bases and surfaces; in concrete acceleration and curing; in ice control and snow removal; and in special uses such as dust laying and surface binding and weighing tractor tires with calcium chloride. Calcium Chloride Association, 909 Ring Bldg., Washington 6, D. C.

Fusion Welding of Nickel

A new, 44-page booklet, Technical Bulletin T-2, on the fusion welding of nickel and the high nickel alloys has just been published by The International Nickel Co., Inc. It contains 44 pages and includes more than 30 tables and almost 50 drawings and photographic illustrations. A complete technical treatise on the subject, it covers various forms of electric arc welding as well as gas welding. There are over 20 chapters and sections covering, in addition to detailed welding instructions, such information of importance to production and welding engineers as the boiler code of the American Society of Mechanical Engineers, pickling, testing and inspection safety methods and associated topics. Technical Service Section of The International Nickel Co., 67 Wall St., New York 5, N. Y.

Protective Paints

A four page technical folder containing a quick reference index to quickly determine the most suitable coatings for rust prevention, chemical corrosion, and dampness is available from The Wilbur & Williams Co., 130 Lincoln St., Brighton 35, Mass.

Blast-Cleaning Equipment

A new catalog by Vacu-Blast Co., Inc., tells in detail uses and advantages of the company's "Vacu-Blaster"—a compact, movable blast-cleaning equipment for metal, concrete, brick, stone or wood surfaces. The catalog contains numerous drawings and action photos showing how Vacu-Blaster works. Special sections explain advantages of the unit in welding operations, and in the maintaining of rolling stock, plants and buildings. Another section deals with unusual or difficult blast-cleaning applications. The unit has a dustless vacuum pickup which removes abrasives and debris simultaneously with the blasting operation. Vacu-Blast Co., Inc., 350 Peninsular Ave., San Mateo, Calif.

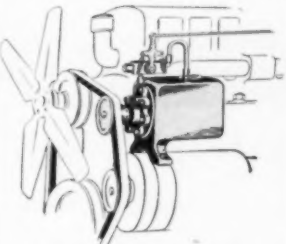
Tractor Shovel

A new catalog is available covering one of the newest of the Hough Pay-loader tractor shovels, the Model HY. Many action views are used showing how this 1½ cu. yd. capacity machine is serving the construction and public works fields and solving materials handling problems in many industries. Features such as full-reversing transmission, operator visibility and safety, full hy-

POWER HYDRAULICS for Snow Plows and Road Machinery



Specify Monarch controls when ordering snow plows



- Clutch operated (Optional)
- Thousands in use
- Fan Belt or Electrically Driven
- Fit All Trucks

MONARCH ROAD MACH. CO.

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SAUERMAN CRESCENT SCRAPER



Here is the popular lightweight model Crescent scraper bucket used for ordinary excavating. Crescents are built in four other models and fifteen sizes ranging from 1/3 to 15 cu. yd.

On thousands of earthmoving jobs, Sauerman Scraper machines equipped with the unique Crescent bottomless bucket, are cutting costs in digging, hauling and dumping almost every kind of material.

A Crescent scraper bucket penetrates tough materials with ease, gets a full load quickly, hauls this load at speed of 400 to 600 f.p.m.—all with economical use of power.

Write for illustrated catalog.

SAUERMAN BROS., INC.

588 S. Clinton St.

Chicago 7, Ill.



SNOW-REM
SNOW PLOW WAX
 Carnauba and SILICONE
Makes snow removal faster, easier, cheaper.



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VULCAN PAVEMENT AND CLAY DIGGING TOOLS

ARE MADE in a complete line of sizes to fit all standard compressed air hammers.

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NOTED FOR QUALITY AND DURABILITY™

VULCAN TOOL MFG. CO.
 QUINCY, MASS.

draulic bucket control, power booster steering and unique unit-design Pay-loader construction are clearly illustrated as well as important design details and complete specifications. The Frank G. Hough Co., 871 Seventh St., Libertyville, Ill.

Aluminum Street Lighting Poles

A new 20-page catalog, No. 80, devoted to their extensive line of aluminum poles for street and highway lighting, announced by The Union Metal Manufacturing Co. is complete with engineering tables covering both fluted and plain round designs, various bracket styles with spreads ranging from 4 to 15 ft. and mounting heights from 19 to 37 ft. Poles can be furnished with or without transformer bases. The Union Metal Manufacturing Co., Canton 5, O.

Plastic Snap-on Map Sticks

The method of mounting maps, drawings, tracings or blueprints on Kraftbilt all-plastic snap-on map sticks is illustrated in a 4-page bulletin. No nails, screws, glue or adhesives is needed, the firm tension of plastic stick clips holds the map in place. Once mounted the map is held fast to the stick, permanently if desired. At any time the map may be removed quickly and a new map fastened in its place. Ross-Martin Co., P.O. Box 800, 423 East Fourth, Tulsa 1, Okla.

Pile Driving

The ingenious methods of building the foundations and driving the piles for the construction of the Chesapeake Bay

bridge, now nearing completion, are described in Bulletin 62 by McKiernan-Terry Corporation, who supplied 20 single-acting and double-acting pile hammers and excavators for four contractors engaged in the work. The illustrations include a birds-eye drawing of the bridge and its approaches, an elevation sketch of the bridge, which is to be the second longest in the world, and more than a dozen views showing the methods of driving the piles for the deep water piers and suspension bridge anchorages and successive steps in the progress of the construction of the bridge. McKiernan-Terry Corp., Dept. RS, 15 Park Row, New York, N.Y.

Crawler Tractors; Power Units

A new 12-page brochure published by the International Harvester Co. shows the full line of International crawler tractors at work improving and maintaining roads, powering sanitary landfill garbage disposal operations and on snow removal applications. International diesel power unit installations in city generating and pumping stations are also pictured. International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

Concrete Mixing Unit

Applications and specifications of the 1-yd. Mixermobile are included in a 4-page circular. The Mixermobile is a complete mobile concrete mixing unit and elevator. It is stated that it can be set up ready to pour within 10 minutes after arrival on the job. The unit is stated to have a capacity of 200 cu. yd. of concrete in 8 hours. Mixermobile Manufacturers, 6855 N.E. Halsey St., Portland 16, Ore.

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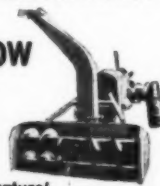
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2	Super "C" Tournapelle with 12 to 15 yard scrapers, powered by Cummins 150 horsepower, 6 cylinder diesel engine; with cab; all in the 5000 series serial numbers; excellent mechanical shape.	11	2 1/2-yard Jaeger High Discharge, end loader, Truck Mixers. Mounted on LFSW Mack Trucks, with ten (10.00 x 22) 14 ply tires on each truck; powered by Mack EN510A gasoline engines. All equipment new in 1951. Excellent buy.	31	Ballie Vibrator with 2' of flexible shaft.
3	"C" Tournapelle with an 11-yard heaped scraper, powered by a Caterpillar diesel engine. Very reasonable buy.	12	5-yard capacity Jaeger Truck Mixers, Horizontal type. Separate engine drive. Good price. Both unmounted.	32	Jaeger 1 1/2 Self Priming Centrifugal Pumps.
4	LeTourneau Tilted blade, NEW, for a D-6 Caterpillar tractor; cable operated; can be used as a straight dozer blade. Good price.	13	4-yard capacity Ransome Truck Mixers, Horizontal type. Separate engine drive. Attractively priced. Both unmounted.	33	Jaeger 2P, two-inch pumps, gasoline powered, self priming.
5	International TD-18 tractor, wide tracks, with power control unit, and hydraulic arms for bulldozer blade; clean. Very good condition.	14	60 cfm Schramm Air Compressor, serial number 90181.	34	Jaeger 3P, three-inch self priming centrifugal pumps.
6	LeTourneau double drum power control unit. NEW T series. Excellent buy.	15	75 cfm Jaeger Air Compressors.	35	Marlow 3P, three-inch pump.
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8	Terratract tractor, model GT 25, with loader attachment powered by a 25 horsepower Continental gasoline engine, 10-inch crawler pads. About one year old. Moderately priced.	17	3 Thor number 23 Paving Breakers.	37	Jaeger 4 X P, 4-inch self priming centrifugal pumps, gasoline powered, capacity 30,000 gallons per hour.
SPECIAL					
9	2 Jaeger 365 cubic foot compressors powered by International UD-18A diesel engines, four pneumatic tires on each. Very excellent condition.	18	Thor number 25 Paving Breakers.	38	Jaeger 4P, four-inch self priming centrifugal pumps, gasoline powered, capacity 40,000 gallons per hour.
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SPECIAL					
13	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	22	Thor number 75 Rockdrill serial number 65127.	42	10 EL Jaeger Concrete Mixers, with skips and also Hoppers, water tanks, gasoline powered.
SPECIAL					
14	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	23	133 cfm 1/2" hex chuck Thor chipping hammer.	43	Jaeger 7 EL Concrete Mixers, with skips, water tanks, gasoline powered.
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15	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	24	30" Malt air powered chain saw.	44	Jaeger EL Portable Concrete Mixers, skip loader, gasoline powered.
SPECIAL					
16	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	25	Beach saw table 10-A, 14" blade, gasoline powered.	45	Jaeger 3 1/2, SNT Hopper Type portable Concrete Mixer, gasoline powered.
SPECIAL					
17	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	26	Model 31 CH&E Saw Table, 14" blade, 5 h.p. gasoline engine.	46	Jaeger 3 1/2, ST tilting type portable Concrete Mixer, gasoline powered.
SPECIAL					
18	Unit model 1014 truck crane, 10 ton, 1/2 cubic yard capacity, used, EXCELLENT CONDITION, like new. About one year old, seen very little work, set up for Crane or Clamshell work, has 1/2 yd. bucket, 10 feet of boom. Excellent rubber, ten 8.00 x 20 tires, Waukegan engines in truck and crane.	27	Jaeger Hoister Towers complete with Hoist and 37 feet of hoister tower. Additional tower available up to 67 feet.	47	Jaeger Plaster Mortar Mixers, model 6-6 PV, gasoline powered, 1 bag capacity.
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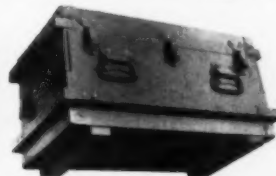
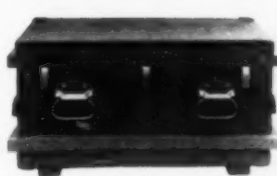
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Used Approximately Ninety Days for 45,000 Square Yards Paving

Rex 34E double drum paver #OD229.....\$27,500.00

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1 Blaw Knox spreading machine #RAS223.....\$3,000.00

1 Buckeye fine grader #238.....\$3,500.00

1 Galton 3-3 ton roller (tandem) #TG16540, engine #VP4-1450105.....\$3,200.00

All Prices F.O.B. Our Yard and Net to Us

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CATERPILLAR Kid-Size CRAWLER TRACTOR

Electric Motor Driven! Rugged full-track pulls loads easily over lawns, fields, pavements. Most sensational child's vehicle made! Catalog Free.

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LePlant Chaboat "C-44" New 4 yd. Hydraulic Scraper, Discount
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Res "27E" Paver, Big Drum, ready to pave

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3—TD-18 International Tractors—2 with DDPCU. One with Bucyrus-Erie hydraulic dozer blade.
One angle dozer blade—Two with 15 cu. yd. Le Tourneau scrapers. All Rebuilt in A-1 Top Condition.

HD-14C Tractor Torque-converter with Le Tourneau Scraper
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225 GM Diesel 1/4 yd.

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CATERPILLAR D4 Tractor with dozer.

MACK TRUCK with 9 cu. yd. Rock Box.

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Cat Diesel.

All machinery has low hours since complete rebuild
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Located Hardwick and Barre, Vermont

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Caterpillar 12 Motor Grader	\$9,250.00
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Caterpillar 70 Scraper like new	\$6,850.00
Caterpillar 80 Scraper like new	\$4,850.00
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Caterpillar D8, D7, D6, & D4 Tractors
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(70 ton capacity), High-Lift 2 1/2 yard
shovel, 100' Boom Dragline. New 1950.
Used only 9 months, like new. Replacement Cost \$95,500. Will take \$75,000 complete. RENTAL quoted on request.

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- 1—Cat. 2 1/2 Motor Grader.
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- 1—Cedar Rapids Portable 10 x 20 Crusher 24" Elevator—Gas Power Unit.
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- 1—New 225 Bros Steam Generator.
- 1—New 275W Motor Bucket Loader.
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Scopmobile—1 cu. yd. bucket, lift
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Used about 100 hours. Like new. Sacrifice.

1947 Dodge 2-ton truck—All steel
Freuhauf, 12 ft. flat bed with hydraulic
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1—JAEGER 5 Yard 2 Compartment water tank. Model
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All with Cummins diesels
Trucks in excellent condition

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One month's use.

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HOISTS—Two gasoline powered. One electric.
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Blade, LaPlant Chaboat, Model BM 4, 124"

Overall 550.00

Loader, Hough 1/4 yd., with Blade and Dual

Rears 2500.00

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Mixer, Jaeger 11 S, 2 wheel pneumatic 1450.00

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Diesel 40 "Caterpillar" tractor with Le-
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Lorain shovel, Model 75A, 1 1/4 cu. yd.
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This machine is almost new, has been completely checked over and repainted. The new current price is approximately \$5500 but we have priced this one at:

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Complete with male and female couplings, 200-lbs. pressure, rubber-lined, in 50-ft. lengths.

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FIRE HOSE: Sewer & Trench work; Manholes; Discharge on Pumps; Mines. 50-ft. length, complete with fittings \$30.00

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 - 1—New Jager 10" gas driven pump, \$1,200.00.
 - 1—Owen 1/2 yd. Type O double shaft heavy clam shell with teeth, \$500.00.
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Walking draglines, diesel, 10-yd., 6-yd., 3-yd.
Shovel cranes, diesel, elec., gas, 1 1/2 yd.
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Crushers, jaw, gyratory, 18" to 48" (7).
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P&H Truck—crane, 75' bn., Mack truck, 15-20 ton.
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Available Northwest machines in all sizes as of November 1st, 1951. All machines are sold f.o.b. cars and subject to prior sales. Every machine is in excellent mechanical condition and is a late model, and diesel powered.

Two 1950 Model 95 draglines 80 ft booms 2 1/2 yd bhts
Two 1948 Model 95 draglines 80 ft booms 2 1/2 yd bhts
Two 1948 Model 95 draglines 80 ft booms 2 1/2 yd bhts

One 1951 Model 80-D shovel
Two 1950 Model 80-D shovels light plants
One 1948 Model 80-D shovel
Two 1948 Model 80-D shovel-draglines 75 ft booms
One 1947 Model 80-D shovel-dragline 75 ft booms

Two 1948 Model 6 shovels
Two 1948 Model 6 shovel-draglines 60 ft booms
One 1947 Model 6 Clam-drag 60 ft boom 33" cats
One 1947 Model 6 Pullshovel
One 1946 Model 6 Pullshovel—rebuild

One 1950 Model 25 pullshovel—28" cats
One 1949 Model 25 pullshovel—28" cats
One 1948 Model 25 shovel
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One 1948 Model 25 pullshovel 28" cats
Two 1948 Model 25 Clam-drag 40 ft boom 28" cats
One 1947 Model 25 Clam-drag-crane 50 ft boom 28" cats
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Many of the older and discontinued models are available in all sizes, and attachments (shovel—pullshovel—dragline and clamshell) are ready for immediate shipment, except pullshovel attachments for 80-D or 95. We specialize on Northwest equipment and will mail our complete list upon application. It covers eighty-five machines plus attachments.

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Will rent the above equipment on long term bases only.

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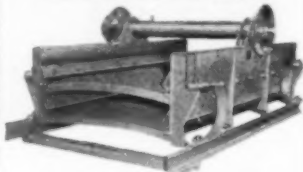
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Portable Concrete Plant Complete—Erie Mixer —1 1/2 yd. with 10% surcharge capacity up to 30 cu. yds. per hour—capacity of bin 20 cu. yds., 3 equal compartments—capacity of elevator, 60 tons per hour—operating controls—hydraulic on all gates—power unit—Hercules JXC 6 cyl. engine, Hires—eight 7.50/15 10-ply tires—duals —manufacturer, Erie Steel Const. Co. Condition, used only 6 months.

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Boom. Excellent condition.

2 unit Iowa Portable Rock Crusher.
Reas. Excellent condition.

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2500 Manitowac Speedcrane, 85' boom, 2 1/2 yd. BHD bucket, D-17000 Caterpillar engine, 16'4" crawlers, 38" treads, Kohler light plant. Excellent condition.

1201 Lima Dragline, with 100' boom, 2 1/2 yd. bucket, 6 cyl., Type L Cummins engine, 19'11" crawlers, 44" treads, all air controls. About 2 years old—very fine condition.

1201 Lima Standard Shovel, with air controls, 18'11" crawlers, 44" treads, 22'6" boom, 22' dipper handle, 3 1/2 yd. dipper, Type L Cummins Diesel engine. Worked very little—like new.

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Secondary Crushing Plant w/Diesel Power, rated capacity 100 T.P.H. minus 1 1/4" with 6"-8" feed. Includes all units to feed, scalp, crush, screen and load two trucks. 100% portable and may be inspected in operation. Immediately available. Specs., price and terms on request.

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3 Super C Tournapulls w/ Cummins Engines. Machines and tires excellent condition. Must move immediately for bank settlement. \$6500 each.

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Crane Unit powered by JXD Hercules Engine Serial # 1708241 Carrier Unit powered by WXL-3 Hercules Engine Serial # 2109055.

This Unit was purchased on April 19, 1951 and has been used very little.

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BYERS 1/2 YD. CRANE—MODEL 83 in good working condition, and 3000 FT. ROAD FORMS

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Model 104 Northwest Dragline, late model tracks, high speed gear train.
Model 101 Adams Tandem Motor Grader.
Model HD 7 A.C. Tractor with Baker Bulldozer. All in good condition, priced for quick sale.

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COMPLETE ASPHALT PLANT INCLUDING POWER UNITS. PLANT NOW IN OPERATION. 5000 LBS., BATCH MIXER.

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P&H 255A DRAGLINE, NEW.
BYERS 65, BYERS 83, UNUSED.
NEW OSGOOD 200, INSLEY K-12.
LORAIN 80 DRAGLINE, MICHIGAN TLDT20.
KEYSTONE 18A CRAWLER, 18AT TRUCK CRANE.
NORTHWEST 25, "CAT" DIESEL, LIKE NEW.
GARDNER-DENVER, SULLIVAN, CHICAGO-PNEUMATIC, DAVEY, SCHRAM, ETC., 60 TO 315 COMPRESSORS.
12 TRUCK CRANES FOR RENT ONLY.

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Two Jaeger 3-yr. Truck Mixers, flush and mixing tanks, 3 years old, fair to good condition.

Used Unit Model 1020, ¾-yd. Dragline, 35' boom, 11' crawlers, 24" shoes, GM diesel engine; 4½ years old; good condition.

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80-KW 75-KVA, 440 volt, 60 cycle, 1200 RPM generator with General Motors 6016C engine, regulators and instruments, used 200 hours.
General Electric 25 h.p. 3/60/220-440 volt, 900 RPM motor.
1-D4 Traxcavator.
1-D2 Traxcavator. Both in excellent cond.
Worthington 315' compressor on steel, good condition.

Write or phone for prices
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FOR SALE

1-Galion International Power
Patrol Motor Grader
Late model 2 years old
Perfect Condition, Like New

Sacrifice \$7,500
OTTO WIESNER
SUPERIOR, WISCONSIN
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1918

1951

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KOEHRING Model 605 shovel, dragline combination, "Caterpillar"
D-13000 power, 4 years old.....\$25,000.00

TRACTOR, IHC Model TD-14 with Bucyrus-Erie hydraulic bulldozer.....\$6,250.00

PIONEER 1536 roller bearing jaw crusher, skid mtd.....\$4,500.00

MARION Model 331 ¾ yd. shovel, 2 years old.....\$14,000.00

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Immediate Delivery

- 1—Allis-Chalmers Model H-D7W tractor w/ Gar Wood bulldozer.
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- 1—"Caterpillar" D2 w/ traxcavator. Very clean.
- 1—"Caterpillar" Model 212 motor grader.
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- 1—Huber maintainer, good condition.
- 1—Gar Wood Model 508 scraper.
- 1—P & H Model WN300 portable welder.
- 1—P & H Model WN200 portable welder.
- 1—Bros Model SG-55 skid mounted steam generator.
- 1—Allis - Chalmers HD7W and Gar Wood hyd. angle dozer.
- 1—Allis-Chalmers Model H-D10W w/Buckeye bulldozer & Gar Wood DDCU.
- 1—LeTourneau 3½ cu. yd. scraper. Very clean.
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Three Continental Model M330, 75 h.p. gasoline power units. Price right for quick sale.

1 U2, 22 h.p. International Harvester power unit, complete with radiator and clutch.

Lorain Sheel Front—With like new 1½-yd. Rock Dipper. Boom & Stick \$2,200 f.o.b. your truck.

Three American Bosch Diesel fuel injectors.

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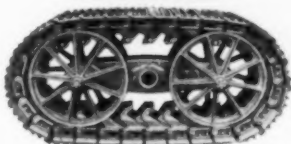
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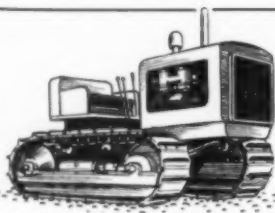
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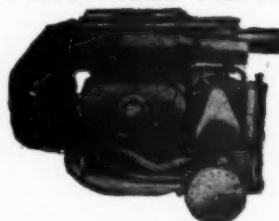
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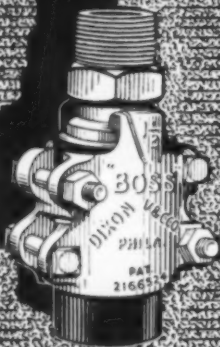
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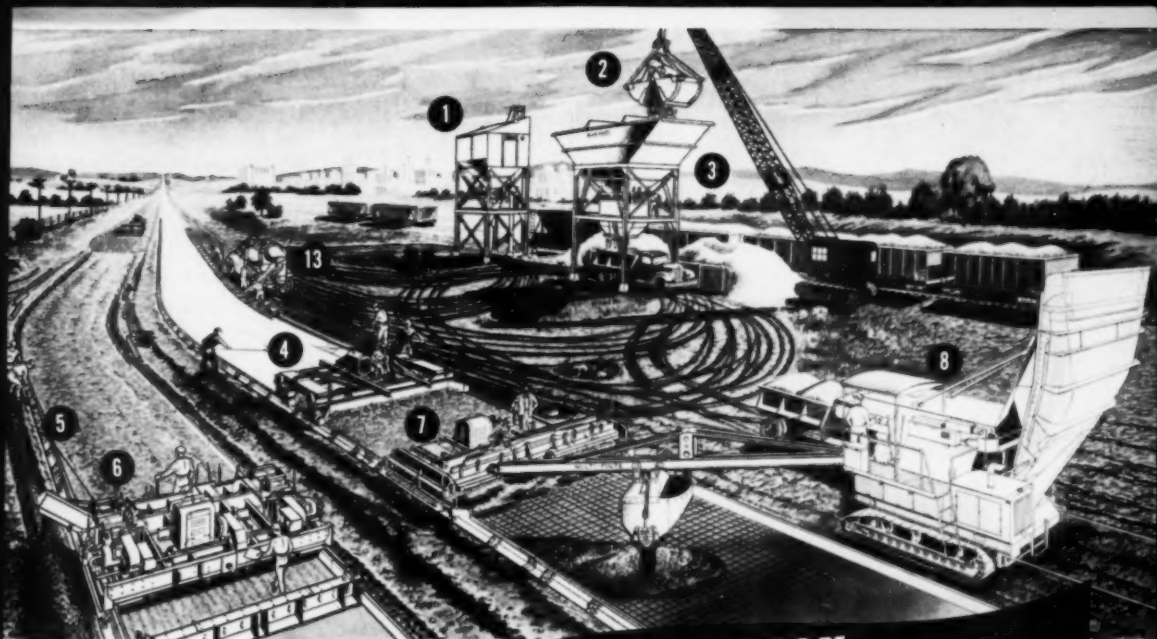
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